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Record Steel Production of 1929 Was Supported by an Even More Diversified Demand Than That of Previous Year

¶ *Exceeding expectations,* 1929 *made a new record in steel output, surpassing the previous peak year,* 1928, *by* 8½ *per cent. The ingot total,* 54,600,000 *tons, was* 4,275,000 *tons higher than in the preceding* 12 *months.*

¶ *Earnings, the largest in time of peace, were accelerated by near-capacity operations in the first three-quarters, reaching their highest in the second quarter.*

¶ *Demand was well diversified. Railroads, utilities and miscellaneous users took larger shares of the finished steel made than in* 1928. *The proportions for the automobile industry and for building remained unchanged, although both took larger tonnages.*

¶ *Production and prices reached their low points in the fourth quarter, in contrast with the previous year when they reached their peaks in that quarter.*

¶ *Additions to open-hearth capacity totaled* 1,005,000 *tons, by far the largest since the war. Plans for* 1930 *call for an increase of* 4,690,000 *tons, which exceeds the gain of* 1916, *the greatest ever made.*

TWELVE months ago, following a year of record production and excellent earnings, there was little expectation that 1929 would be a still better steel year. Yet the 1928 steel ingot output was exceeded by 8½ per cent and steel company earnings reached new peace-time peaks.

Steady output, stable prices and diversified demand, which marked the previous year, were even more characteristic of the first three quarters of 1929. The intervention of the stock market panic in October dried up buying and drove down consumer inventories in the final three months of the year—probably to a much greater extent than it depressed the actual consumption of iron and steel.

Demand was even better balanced than in 1928, in view of the increased requirements of the railroads and utilities and the further growth of miscellaneous uses of steel, and for the major part of the year mills were hard put to supply their customers' wants. Early in 1929 mill deliveries began to extend and a shortage of semi-finished steel developed.

Mill Deliveries Were Extended

By the middle of March some mills were fully committed for more than three months on automobile body sheets and for two months on all finishes. A similar situation also obtained in hot-rolled strip steel, in certain cases forcing users to turn to light plates to supplement their strip stocks. A scarcity of crude steel developed, becoming so acute that producers which ordinarily have a surplus entered the market in an effort to obtain additional supplies. Several orders for ingots were placed by integrated producers, the first important purchases of that product in several years. Idle Bessemer equipment was put into ser-

vice, and more pig iron was used. Steel makers that are ordinarily sellers of excess pig iron found their own supplies inadequate. Advances in the Valley pig iron market and the blowing in of additional furnaces followed. By the middle of June blast furnace operations in the Pittsburgh district were at the highest rate since the war.

In short, producers' surplus stocks of pig iron and crude steel were wiped out. Integrated companies were forced to allocate steel among their various finishing departments, and non-integrated companies in some instances were unable to obtain their full requirements. In March the scarcity of steel caused interruptions in Valley sheet and strip mill operations. In May certain Chicago companies were held down to 85 per cent production, notwithstanding efforts to buy semi-finished steel from other districts.

Cross Hauling of Steel

"Cross hauling" of steel, which has been condemned at times as uneconomic, became a market feature rather early in the year, not because of a dearth of business, but rather on account of a shortage of capacity. In fact, overflow demands from the Chicago district passed to mills farther east for a period lasting several months. The chief scarcity was in plates, the consumption of which was greatly expanded by the heavy requirements of railroad equipment builders and the A. O. Smith Corporation, Milwaukee, manufacturer of electrically welded pipe.

Chicago plate mills were reported as operating at capacity at the beginning of February, when the Milwaukee company was already taking 1000 tons a day. That plant's consumption, however, continued to expand, reaching a total of 80,000 tons in its peak month. More and more tonnage had to be bought from mills outside the Chicago territory, some orders reaching producers as far east as the Philadelphia district. In May a Lake Erie mill, which had shipped a boatload of finished steel a week to Chicago during the 1928 navigation season, inaugurated a schedule calling for the delivery of two cargoes weekly.

Pressure for Plates Persists

Improvement of mill deliveries on heavier rolled products did not occur as soon as on some of the lighter forms of finished steel. Early in June Pittsburgh plate mills were still 10 to 12 weeks behind, and Chicago deliveries on plates and bars ranged from 12 to 14 weeks. By the middle of July fairly satisfactory shipments were again obtainable on most products and the scarcity of semi-finished steel was relieved, although depleted reserves had not yet been replenished. Pressure for plates, however, persisted throughout the summer. Late in August Chicago plate mills were still booked for four to 10 weeks and Pittsburgh plate producers for six to eight weeks.

Despite the gradual betterment of mill deliveries in the third quarter, the industry experienced no summer lull. Total steel output for July, August and September exceeded that of the first quarter and was a good runner-up to the record-breaking second quarter production. Rail mill operations at Chicago did not experience the usual seasonal suspension, but continued through until October, when the autumn rail buying movement got into full swing.

Demand More Diversified

Demand during the first three quarters of the year was characterized by an increasing diversification, in part reflecting the growth of new uses for steel. It is becoming more and more evident that iron and steel cut across virtually all industries and it is no longer possible adequately to judge the steel market by demands emanating from a few outstanding consuming groups.

Throughout the year the automobile industry, which produced at a record rate, was closely watched by the steel trade. While that industry used much more tonnage than in 1928, its proportion of all the finished steel made remained unchanged at 18 per cent.

Construction work, featured by record awards of structural steel, also accounted for no larger share of the total —the percentages for the two years having been identical at 16½ per cent.

The increased requirements of the railroads, which were so conspicuous on account of large orders for cars and locomotives, were also given more attention than they deserved. It is true that the railroads took more steel, but the gain in ratio was only 1 point—from 16 per cent of the total for 1928 to 17 per cent for 1929.

On the other hand, the share of the utilities and mining and lumber companies, 10½ per cent, showed a gain of 1 point, while the large miscellaneous group ("all others"), 19 per cent, accounted for an increase of ½ point.

Marked Increase in Exports of Manufactures

The share of exports declined ½ point to 5½ per cent, although the total tonnage shipped abroad was undoubtedly the largest since 1920. However, an increasing amount of steel also went into manufactures that were exported. In the first nine months of the year both machinery and automobiles displaced cotton as the leading item in export trade. The number of motor vehicles sold in other countries in 1929 (exports and output in American owned Canadian plants) is estimated by the National Automobile Chamber of Commerce at 1,015,000, a gain of 18 per cent over 1928. Machinery exports in 11 months passed $563,000,000, a gain of 24 per cent over the total for 1928 and larger than any previous full-year figure. Eleven months' shipments abroad of farm equipment, at $128,523,000, showed an increase of 19 per cent over the record-breaking exports of the previous year.

The growing diversification of the steel industry is also indicated by 1929 production of leading finished products, as given on succeeding pages. All of the totals were larger than in 1928 except that for wire products, which declined. New records were established by bars, structural shapes, sheets, tin plate, pipe and strip steel.

Overstimulation of Steel Consumption?

The growing uses for steel help explain producers' confidence in the future, as indicated by their plans for expansion. The stock market crash, of course, raised doubts as to whether the activities of steel-consuming lines had not been excessively stimulated. An answer to this question, as well as to the related one—how much the buying power of the ultimate consumer was crippled—cannot yet be made. It seems apparent, however, that inflation, if it did exist, was represented by a speeding up of the consumption of steel and did not find reflection in swollen inventories or high prices. It is true that inventories regarded as normal for a high rate of industrial activity may have looked large in the psychological depression that followed the Wall Street panic, and it may be added these supplies were reduced to the vanishing point by the year-end. Cancellations, however, were few and, as confidence rose among buyers, orders that were suspended—which were not in great volume—were reinstated.

One of the most heartening features of the post-panic period was the sustained demand from the railroads, the structural steel industry, the shipbuilders and the farm equipment makers. With the flow of steel into these outlets showing no diminution, the extreme caution among other buyers tended to disappear. Another source of encouragement at the close of the year was an upturn in the scrap market, a barometer that is always closely watched.

Late in December heavy melting steel at Pittsburgh rose 50c. a ton, the first advance in that grade since Aug. 13.

Volume Spells Profits

Additions to open-hearth capacity in 1929 totaled 1,005,000 tons, comparing with a gain of 895,000 tons in annual capacity in 1928, the previous post-war record. Plans for 1930 call for a further expansion totaling 4,690,000 tons, which will exceed the greatest increase made during the war period.

In part this program undoubtedly reflects the faith of the industry in the continued growth of its markets, but it also indicates a striving for additional economies. Steel companies still see the possibility of making important reductions in producing costs, nothwithstanding the rather common impression that the opportunities for progress in that direction have been largely exhausted. The pressure for economies is also seen in the continued integration of steel companies into larger units, which is referred to in detail in a later paragraph.

The increasing importance attached to large organizations and large units of producing equipment is matched by the greater emphasis placed on volume of output. In 1929 a high rate of operations was found to have a much greater influence on profits than prices. In the first three quarters prices, as measured by THE IRON AGE composite for finished steel, averaged less than 2½ per cent higher than in the same period of 1928, but steel ingot production for the country showed a gain of 17 per cent and total earnings of the Steel Corporation (after deducting expenses, taxes and interest) rose 44½ per cent.

Steel Prices Recede at Year-End

Steel prices for the entire 12 months of 1929, in terms of the finished steel composite, showed a gain of less than 2 per cent over 1928. The increases of the first and second quarters, however, were more than lost in the last four months of the year. Plates, shapes and bars advanced in the second quarter $1 a ton to 1.95c., Pittsburgh, but toward the end of September bars and shapes declined to 1.90c., and at the close of October plates fell to the same level. Various advances were made in sheets during the year, but the higher prices were effective on a relatively small amount of business and at the year-end most of the different finishes were $2 to $4 a ton lower than at the beginning of 1929. Black sheets stood at 2.75c., compared with 2.85c., Pittsburgh; galvanized sheets at 3.40c., compared with 3.60c.; and automobile body sheets at 4c., compared with 4.10c. Wire products also lost ground. Plain wire at the year-end stood at $2.40, Pittsburgh, compared with $2.50 at the start of 1929; wire nails were at $2.40, compared with $2.65. On a similar comparative basis cold-rolled strip steel showed a net loss of $2 a ton and hot-rolled strip a net gain of $2.

Cold-finished bars advanced to 2.30c., Pittsburgh or Chicago, beginning with the second quarter, and held at that level until November, when there was a decline of $2 a ton to 2.20c., the same price that prevailed in the first quarter. During the year the Cleveland base price on this product was reduced to a parity with the Pittsburgh and Chicago bases. Another development was the establishment of a new base price at Buffalo, also on the same level as the other bases.

Blue Annealed Sheets Divided into Two Groups

Among changes in the methods of quoting prices was the adoption, in May, of a new classification of blue annealed sheets, under which separate bases were established for No. 12 gage and heavier and No. 13 gage and lighter. In February a new card of extras was established for cold-rolled strip to bring net prices in closer conformity with production costs. The effect was moderately large reductions on the wide and heavier sizes and rather sharp increases on light-gage, narrow material. In April extras on metal furniture sheets were advanced. In May alloy steel bar makers placed square billets under 4 x 4 in. and slabs of equivalent sectional area on a bar base. Computed on a gross ton basis the change represented an advance of $2.50 to $6 a ton.

Welded iron pipe discounts were revised in January —the first change since January, 1923. Some of the size brackets were altered and in most cases the new discounts meant lower prices, the reductions ranging from $2 to $20 a ton. Improvement in methods of manufacturing iron pipe and increased competition from seamless steel pipe were given as explanations of the revision.

Advances in Coke and Ore

Prices for primary materials were affected by the sustained pressure on steel producers during the first two-thirds of the year. In January an unusual demand for domestic coke, coupled with extra fuel requirements of the steel companies, started an advance in beehive furnace coke. From $2.75, Connellsville, it rose to a peak of $3.10 early in March. By the middle of April, however, the advance had been entirely wiped out.

At the beginning of the navigation season Lake Superior iron ore was raised 25c a ton—the first change in price since 1925 and the first increase since 1923.

Scarcity of semi-finished steel, as previously indicated, was a factor throughout the first half of 1929. In February an advance of $1 a ton put billets and slabs up to $34 and sheet bars up to $35. In April billets and slabs were advanced $2 a ton and sheet bars $1 to a common price of $36. By the middle of June, however, the market weakened $1 a ton on all three products. Late in December prices receded another dollar to $34.

Alabama Pig Iron Invades the North

Pig iron prices were also influenced by the unusual requirements of the steel industry. This was especially true in the Valleys, but a number of other market centers felt the counteracting effect of severe competition from Alabama furnaces. Merchant pig iron consumption in 1929 reflected the reduced operations of such large users as cast iron pipe, radiator, sanitary ware and heating equipment plants, and Birmingham producers were especially hard hit because of their dependence on the cast pipe foundries. Unsold stocks of Alabama furnaces piled up until they exceeded 500,000 tons. As early as March Southern iron began to invade other districts. Large sales were made at such widely separated points as San Francisco, Kansas City, Chicago, New Jersey and New England. The campaign of Southern producers reached its peak late in August when a large tonnage of basic was sold in the Chicago district at $12, Birmingham, or $4.50 a ton below the price ruling at the beginning of 1929.

Record Pig Iron Output

Pig iron production unquestionably reflected the increased needs of the steel industry, since it reached a peak total of 42,700,000 tons, a gain of 5.8 per cent over the previous record of 40,361,146 tons in 1923. It nevertheless fell nearly 12,000,000 tons short of the output of steel ingots, indicating a large use of scrap. Although no statistics are available, it is believed that the country's total consumption of old material in 1929 may have been as much as 25,000,000 tons.

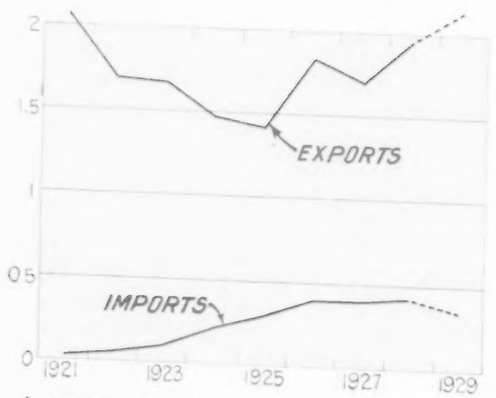
Scrap prices were at their peak for the year in January, when heavy melting steel at Pittsburgh rose to $19.75 a ton, its highest level since February, 1925. This grade advanced again in April and a third time, beginning in June. It reached $19.25 in the middle of August, after which it underwent a steady decline until late in the year, advancing 50c a ton to $15.75 on Dec.

23. The sharpest reductions were in the last two months of 1929, for it was not until after October that the quotation fell below $17.

Scrap Buoyant for 12 Months

The high course of the market had held for virtually a year and, in retrospect, it is interesting to note that the rise in prices that began in October, 1928, and continued until the last week of January, 1929, quite accurately forecast the ascending scale of steel production from January until May, when the peak for 1929 was reached.

Iron ore consumption was in keeping with the high production of steel and pig iron. Water shipments of Lake ore in 1929, at 65,204,600 tons, were more than 500,000 tons larger than in 1916, when the previous rec-



AMERICAN Exports and Imports of Rolled and Finished Steel for Nine Years, 1929 Having December Estimated. The figures represent millions of gross tons

ord was made. Total Lake and rail shipments, however, fell about 700,000 tons short of the 1916 volume.

Record Structural Lettings

While building construction in some lines dropped sharply in 1929, being estimated at $7,677,000,000 against an average of $8,641,000,000 for the previous four years, the types of building work that held up in greatest volume were those requiring heavy tonnages of steel. Residential construction, which takes comparatively little steel, fell off greatly, while commercial and industrial buildings, which usually call for a structural steel framework, made a substantial gain. So did civil engineering projects, in which steel is a large factor.

Thus, the falling off in the total volume of building construction was not reflected adversely in the orders for structural steel, but on the contrary the bookings of the structural steel fabricators, as gathered by the Department of Commerce, are estimated at 3,750,000 net tons for 1929, as against 3,280,000 tons in 1928, a gain of about 12½ per cent. The actual bookings for 11 months of the past year were 3,534,300 tons. December tonnages, not yet officially announced, ran fairly heavy.

A surprising amount of the total volume of fabricated structural steel was erected in the New York district. The compilation of the Structural Steel Board of Trade of New York, which does not include such civil engineering work as tunnels, subways, bridges, elevated transportation structures, etc., totals 600,000 tons, and with the addition of subways, bridges, etc., would be swelled to about 1,000,000 for the New York metropolitan area, or more than one-quarter of the total for the entire country. Although the gain in the whole United States was about 12½ per cent in the bookings of fabricated structural steel, the increase for the New York district, as reflected by the figures of the Structural Steel Board of Trade, was about 23½ per cent, the 1928 total of the types of work it records having been 458,259 tons.

Best Equipment Buying Since 1924

The volume of railroad equipment buying in the past year was more than double that of 1928 and was the largest for any year since 1924. Freight cars ordered totaled 124,140, of which 111,128 were for domestic service, 9899 for Canadian roads and 3023 for export. Only in four years in the past 15 have the total car orders exceeded those of 1929. Buying of locomotives and passenger cars also made a very good showing. Locomotives, numbering 1212, compared with 503 ordered for domestic service in the year before, while passenger cars for domestic service, at 2303, went well ahead of the 1930 ordered in 1928.

The 111,128 freight cars ordered by domestic roads compared with 51,200 in the previous year. However, 1928 was the poorest year the railroad equipment companies had experienced since the war, with the sole exception of 1921, when all business was in a state of depression.

While it does not appear likely that such years as 1922, when 180,154 cars were ordered, and 1924, with 143,728, will be equaled for some time to come, the railroad equipment industry looks for a satisfactory year in 1930, with estimated orders for 100,000 cars or more and 1000 or more locomotives.

Pipe for Natural Gas Lines

One of the outstanding developments of the year was the large expansion of pipe lines for the transportation of natural gas. About 1,300,000 tons of gas and oil pipe were purchased, and much of this was electrically welded pipe produced by a Milwaukee maker, whose demands upon the plate mills for steel created a near-scarcity market for several months.

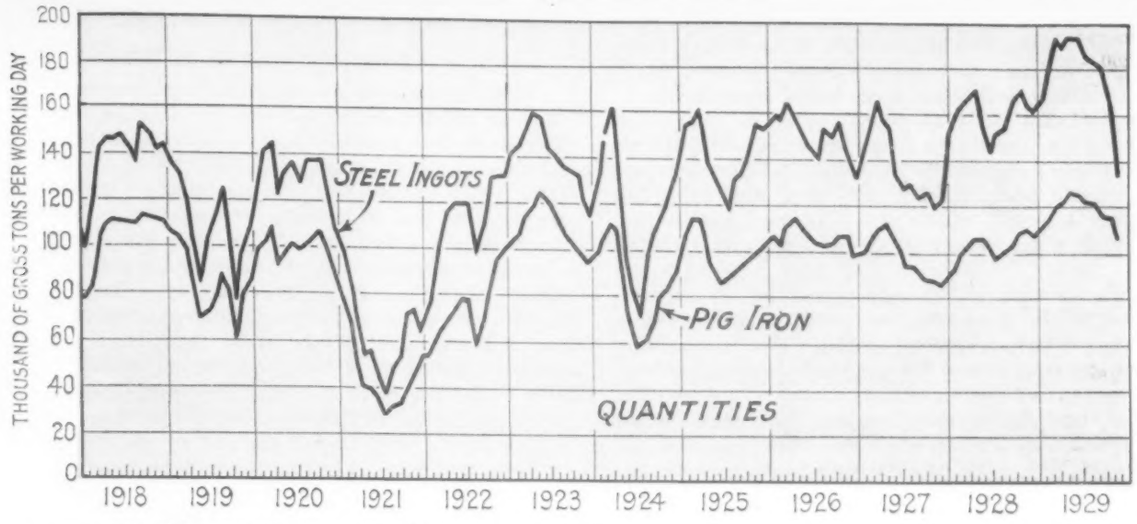
Many pipe lines were built, but the two of major importance were from Southwestern fields to Atlanta, Ga., and to St. Louis, each having approximately 500 miles of main lines, while the Atlanta line, with branches, will ultimately total about 900 miles. This demonstration of the practicability of sending gas under high pressure for hundreds of miles opens up the possibility of further extensions to serve many sections not now receiving a natural gas supply.

Shipbuilding Most Active Since War

Ship construction in the past year was in the largest volume since 1920 and recently has been stimulated to greater activity than it has had since the war. Further expansion is promised by the early award of 28 ships to be built under the mail contract and construction loan provisions of the Merchant Marine Act of 1928. Since last May, contracts have been awarded for 25 sea-going merchant vessels and 48 small commercial ships of miscellaneous types, involving a total expenditure of about $76,300,000. In addition, two naval ship contracts, amounting to $21,000,000, were awarded to private yards.

Waterway Shipments Large

Waterways were used more extensively for the shipment of iron and steel in 1929. The movement on the Allegheny, Monongahela and Ohio rivers, within the jurisdiction of the Pittsburgh office of the United States Corps of Engineers, totaled 2,279,904 tons in the 11



Fluctuations in Daily Average Production of Steel Ingots and of Pig Iron During the Past Twelve Years. While generally parallel, the curves are farther apart than formerly, much farther than in 1921, for instance. They are based on monthly ingot figures of the American Iron and Steel Institute and monthly pig iron figures gathered by **The Iron Age.** Ingots have gone into new heights, far above the great records of 1926 and 1928. Pig iron, also, has made a new high record, exceeding by 6 per cent that of 1923

months ended Nov. 30, compared with 2,262,126 tons in the corresponding period in 1928. The completion of the canalization of the Ohio River is giving impetus to water shipments from Pittsburgh.

The Great Lakes carried large quantities of scrap, pig iron and steel in 1929. The movement of pig iron to Chicago exceeded 50,000 tons, including 2000 tons of spiegeleisen and 2000 tons of low phosphorous shipped from England. Chicago producers, in turn, shipped 6000 tons of pig iron by boat to Muskegon, Mich.

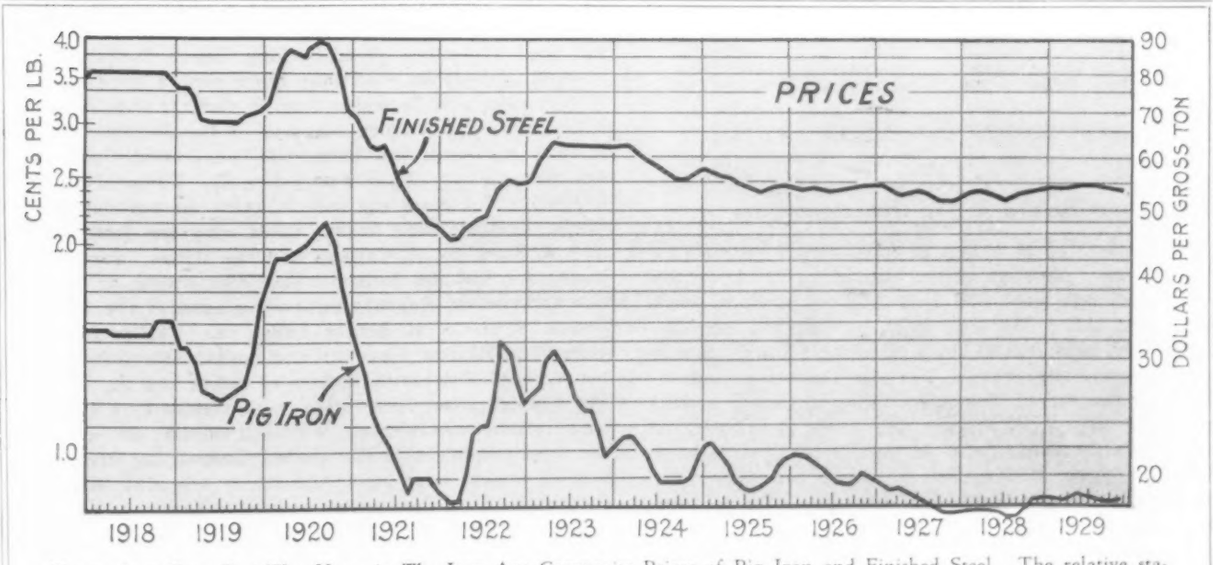
The movement of pig iron and blooms on the New York State canals totaled 173,820 net tons, a gain of 21,125 tons over the 1928 figure. Shipments from Buffalo totaled 102,553 tons, while 53,085 tons originated at Cleveland.

Revised rail-and-water rates from Birmingham to North Atlantic ports were a factor in swelling the movement of Alabama pig iron.

Unparalleled Outpouring of Steel

STEEL production last year, as shown in the heavy black curve on the diagram, has no parallel in any year in the history of the industry. The character of the curve differs considerably, however, from that of 1928, which itself made a new high record. The 1929 ingot output was remarkable not only for its record size but also for the precedent of exceptionally heavy tonnage clear beyond the middle of the year.

A year ago attention was called to the unprecedented gap between output of pig iron and output of ingots,



Fluctuations Over Post-War Years in **The Iron Age** Composite Prices of Pig Iron and Finished Steel. The relative stability of finished steel prices continues to be demonstrated. The highest finished steel composite figure during 1929 was only 2.1 per cent above the lowest, compared with 3.3 per cent in 1928; in pig iron the divergence was 2.75 per cent, compared with 9.1 per cent. Since the peak early in 1923, both trends have been downward. Finished steel has lost 16.1 per cent and pig iron 40.9 per cent

which had reached 12,400,000 tons, against no more than 7,500,000 tons in any preceding year. This year the gap is almost identical with that of 1928, being estimated now at 12,200,000 tons. Both years indicate the use of scrap in steel making on a scale never before experienced.

We estimate the 1929 production of steel ingots at 54,600,000 tons and that of steel castings at 1,550,000 tons. These figures compare with 50,325,393 tons for ingots and 1,218,787 tons for castings in 1928. The ingot figure last year was a record, which now is broken, and castings have made a new record, displacing 1923 with 1,458,000 tons.

While the high rate of ingot output through the summer months was commented on in 1928 as noteworthy of that year, it was as nothing compared with the performance of last year. From February to September inclusive, every month without exception showed a higher daily average ingot output than had ever been made in the highest month of any preceding year. The maximum was reached in May, with June showing an almost identical figure. This contrasts with 1928 and other preceding years, when the maximum has come in April or in March (except when October, 1928, contrary to all precedents, showed a slightly higher daily output than the April peak).

In the following table is given the production of ingots month by month, according to calculations of the American Iron and Steel Institute, based upon reports of open-hearth and Bessemer steel output by companies which made about 94½ per cent of the total ingots in 1928. Crucible and electric steel ingots are not included in this tabulation.

Months 1929	Daily Ingot Production, Gross Tons	Months 1929	Daily Ingot Production, Gross Tons
January	166,309	July	186,080
February	180,250	August	182,491
March	194,548	September	180,435
April	189,924	October	167,098
May	195,302	November	135,116
June	195,255	December	.....

Outputs of steel ingots and pig iron are given below for 1929 and the preceding 11 years:

	Pig Iron, Gross Tons	Steel Ingots, Gross Tons	Steel Ingots and Castings, Gross Tons
1918	39,054,644	43,051,022	44,462,432
1919	31,015,364	33,694,795	34,671,232
1920	36,925,987	40,881,392	42,132,934
1921	16,688,126	19,224,084	19,783,797
1922	27,219,904	34,568,418	35,602,926
1923	40,361,146	43,485,665	44,943,696
1924	31,405,790	36,811,157	37,931,939
1925	36,700,566	44,140,738	45,393,524
1926	39,372,729	46,936,205	48,293,763
1927	36,565,645	43,776,717	44,935,185
1928	38,155,714	50,325,393	51,544,180
1929 (est.)	42,400,000	54,600,000	56,150,000

New Record in Pig Iron Production

AFTER making in 1928 a new low record since before the war, pig iron prices started to climb in the autumn of that year and held a fairly uniform level throughout 1929. The low, which was touched near the end of July, 1928, was $17.04 a gross ton (THE IRON AGE pig iron composite price). The rise reached a peak of $18.59 at the end of November, following which a slow downward movement brought the price, in March, to $18.29. Fairly steady gains during the next two months made the price in May $18.71, which has since been reduced irregularly until in December $18.21 was reached.

Contrasting 1929 with 1928 we find in the first place that total production has gained more than 12 per cent, and that no 1929 month except December fell below 3,000,000 tons. This is the reverse of the situation in 1928, when the first two months were below 3,000,000 tons and all the other months above it. Nineteen twenty-nine made a new high record, being almost 6 per cent above the 1923 total, which was the previous record.

Furnace Abandonment in 1929

Fewer furnaces were scrapped during the year because of being obsolete or uneconomical in operation than was the case in 1928, but the number was none the less large. In place of the 23 of that year only 19 were retired in 1929. With no new furnaces put in blast, the net loss for the year was 19, bringing the total of furnaces on the potentially active list to 317, against 336 a year ago.

Present output is being achieved with a much smaller number of furnaces than a few years ago. For example, in 1926, with almost record-breaking production, the number of furnaces in plants never fell below 213 and reached a maximum of 237. In 1929, on the other hand, with production more than 3,000,000 tons greater, the number of active furnaces reached a maximum of only 219 on June 1 and, toward the end of the year, when business conditions caused a sharp drop, went as low as 177 on Dec. 1.

As was explained last year, the reason for this is the greater unit capacity of the furnaces now in use. The daily rate per furnace in 1926 ranged from 460 to 497 tons on the first of each month. In 1927 this range was from 484 to 516 tons; in 1928, from 515 to 560 tons; in 1929, from 551 tons (January) to 576 tons (June). These figures are demonstrating more and more clearly every year that the small-capacity furnace is no longer to be considered in our present and future pig iron history. The uniformity of the rate through 1929 was noteworthy.

Furnaces in blast at the beginning of each month in 1929, with the current operating rates, are shown in the accompanying table.

1929	Number in Blast	Daily Rate, Gross Tons	1929	Number in Blast	Daily Rate, Gross Tons
Jan. 1	201	110,675	July 1	218	122,590
Feb. 1	202	111,985	Aug. 1	216	121,965
Mar. 1	207	115,770	Sept. 1	210	119,130
Apr. 1	212	120,740	Oct. 1	205	116,405
May 1	215	122,980	Nov. 1	203	113,600
June 1	219	126,150	Dec. 1	177	98,450

A Notable Year for Mergers

UP to the time of the stock market crash the merging of companies in all lines of business continued at the same high rate as in the previous year. This issue of THE IRON AGE lists more than 50 such consolidations in the steel and allied metal-working lines. Despite the reversal of financial conditions, there were a good many in November and December, one, in fact, of outstanding importance—the bringing together of the Republic Iron & Steel Co., the Central Alloy Steel Corporation, the Donner Steel Co. and the Bourne-Fuller Co. Three of these companies had been engaged in prior merger developments, Central Alloy having taken over the Interstate Iron & Steel Co. of Chicago and the Donner Steel Co. having acquired the Witherow Steel Corporation of Pittsburgh, while the Republic company purchased the Union Drawn Steel Co. of Beaver Falls, Pa. Earlier in the year the Witherow Company had bought Dilworth, Porter & Co. of Pittsburgh, makers of spikes and tie plates. The Republic Steel Corporation, to be formed by a grouping of all of these interests, will rank third in size among the steel companies of the United States. Its 5,000,000 tons of annual steel ingot capacity is exceeded only by that of the Steel Corporation and Bethlehem.

A consolidation of the Weirton Steel Co., the Great Lakes Steel Corporation and the blast furnace and ore properties of the M. A. Hanna Co., was effected in September under the name of the National Steel Corporation, which now is sixth in size, having about 2,000,000 tons of

(*Continued on page* 123)



Steel Consuming Industries

Forecasting is a tool that business is trying more and more to use. To take it out of the hunch and clairvoyant class, THE IRON AGE for some years has compiled annually, through the cooperation of the steel makers, the takings of various forms of steel by important industries.

The analysis given immediately at the conclusion of a year offers a basis for estimates by every manufacturer of the promises of the year to come in his own business. To rate his continued activity he may modify, as need be, the performance of the recent past in the light of authoritative opinion respecting particular outlooks.

Accordingly, the pages immediately following are devoted to the prospects of 1930 in the major metalworking fields. The average industrial company is either directly or indirectly connected with one of these. What is likely to happen following recent unusual events is set forth in the several articles, all prepared for the help they may be in the individual case.

Automobiles Took Most Steel

Share, However, No Greater Than in 1928—Railroads Pass Buildings—High Production Records in Six Forms of Steel

FOLLOWING a large increase in steel output in 1928, the production of 1929, as has been known for some time, went far ahead of all predecessors. Returns from almost the entire industry show that practically all the principal forms of steel registered gains, the only apparent loss being in wire products.

Production is estimated at 40,333,000 gross tons of rolled steel, which is much the largest total ever made in any year. The indicated gain over 1928 was 3,155,000 tons, or 8.5 per cent. Last year's estimate, made in the same manner, was 37,300,000 tons, which checked very closely with the final figures of the American Iron and Steel Institute, at 37,177,939 tons.

Estimates of production of rolled steel are based upon returns from 54 steel makers, accounting for a total of 37,688,000 gross tons, or about 94 per cent of the estimated total for the industry. This high rate of return is indicative of the spirit of cooperation of the steel makers in providing, in confidence, information of broad value to the whole industrial field. The tonnage reported by these 54 companies was considerably greater than the aggregate tonnage made by all companies in any preceding year.

More than this, a larger proportion of the companies provided detailed classification of distribution of their shipments, or furnished the basis on which such distribution could be made. This group accounted for 36,348,000 gross tons, or more than 90 per cent of the total output of the year. This is an improvement over the 83.4 per cent of last year and smaller ratios in preceding years. The table at the bottom of pages 10 and 11 shows, as usual, a composite of the data furnished by the industry.

Motor Cars Retain Leadership in Consumption

ANALYSIS of all the returns indicates that the automobile industry absorbed approximately 18 per cent of the entire product, as was the case a year earlier. It had been thought that this percentage would be higher, but the heavy slump in automobile specifications in the last few months apparently returned the figure to that of 1928, but, of course, this represents an actual increase of steel taken, probably of the order of 750,000 tons.

Whereas building and construction was slightly ahead of railroads in tonnage consumed in 1928, the reverse is true in 1929. Building took 16½ per cent, as in the preceding year, but the railroads increased from 16 per cent of the total to 17 per cent, taking second position. Both required much larger tonnages of steel than before.

These three leaders absorbed a little more than one-half of the total production of the industry—51½ per cent, compared with 50½ per cent in 1928. No other industry is within reach of any of these three. Combining the oil, gas, water, mining and lumbering companies, a consumption of about 10½ per cent of the total is shown. Agricultural, including principally machinery and other implements, took 5½ per cent. Exports took a like quantity; containers, in the form of tin cans, and of steel barrels and other carrying units, took about 5 per cent; while machinery took slightly more than 3 per cent.

Miscellaneous industries not included in the above absorbed about 19 per cent of the total, compared with 18½ per cent in 1928. This includes among other things shipbuilding, with about 1 per cent, electrical manufactures, 1¾ per cent, furniture and stoves, with 1⅓ per cent, and pressed and formed metal products, 1 per cent.

Consumption apparently accounted for by the several industries include an estimated 7,239,000 tons for automobiles and automobile parts, 6,895,000 tons for railroads, including trackwork, cars and locomotives, buildings and bridges; 6,539,000 tons for buildings and other construction, including building hardware and trim; 4,180,000 tons for oil, gas, water, mining and lumbering, of which the oil, gas and water absorbed approximately five-sixths; 2,170,000 tons for agricultural needs, 2,073,000 tons for containers of all sorts, and 1,283,000 tons for machinery and hand tools.

Exports, on the basis of returns from the steel companies and checked against the reports of the United States Department of Commerce for the first 11 months, show about 2,270,000 gross tons of rolled steel products shipped abroad during the year. Canada was, by far, our largest customer, with Japan second.

Records Made in Several Products

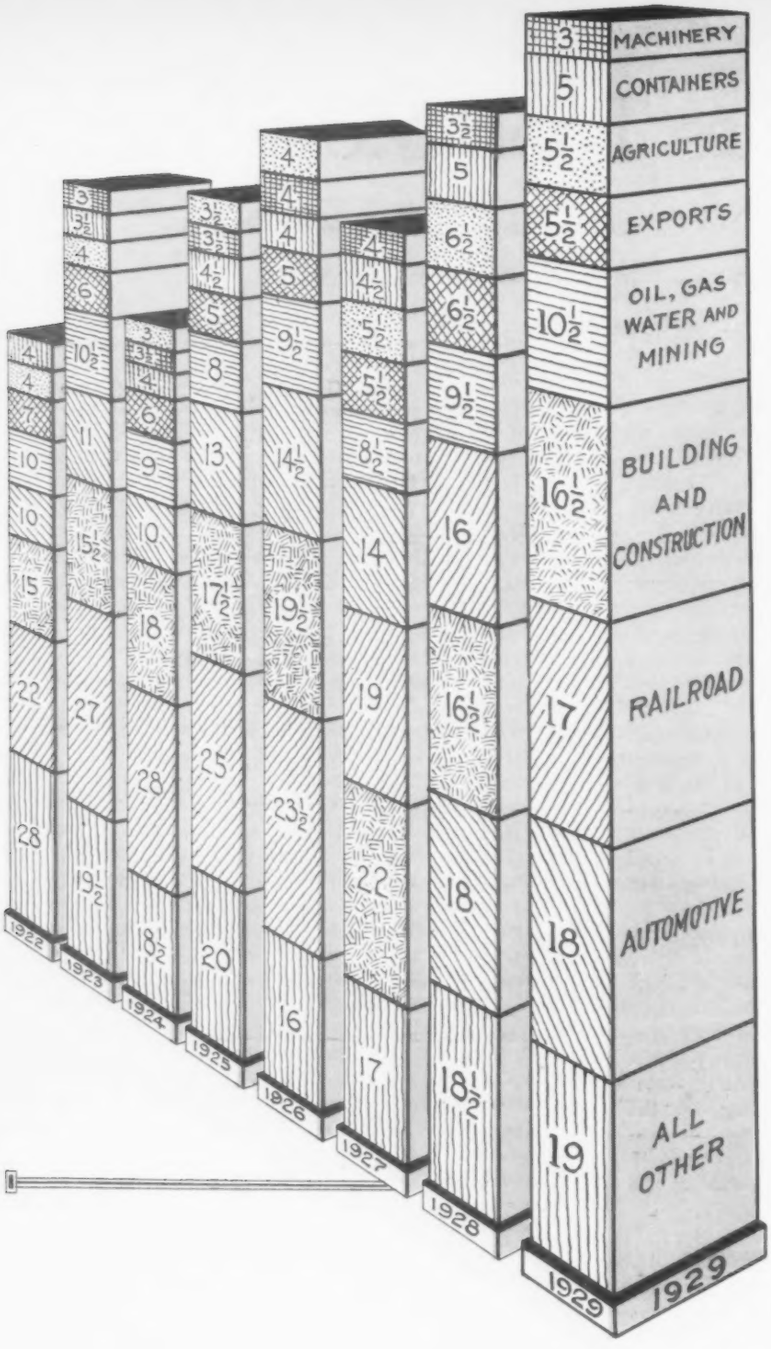
NEW high production records have been made apparently in steel bars, structural shapes, sheets, tin plate, strip steel, and pipes and tubes. All six of these show tonnages considerably in advance of anything previously recorded.

Steel bars are estimated at 7,700,000 gross tons. The previous record, made in 1928, was 7,229,723 tons. That was the first time the high records of 1916

Steel Taken by Leading Consuming Industries in 1929

(Percentages of Principal Forms)

	Bars	Shapes	Plates	Sheets	Tin Plate	Strips	Pipe	Wire
Railroads	7.8	18.7	27.1	3.5	...	0.6	4.0	2.1
Construction	17.4	54.7	17.4	12.7	1.5	7.0	15.3	18.5
Automobile	28.7	0.5	5.4	29.2	1.9	60.4	1.7	9.3
Oil, Gas, Water	2.5	2.7	16.2	2.4	1.4	0.1	54.2	1.5
Mining, Lumbering	1.6	2.3	2.3	1.1	0.2	0.4	2.1	2.9
Agriculture	12.4	1.0	1.2	4.3	0.2	1.5	1.4	24.3
Metal Containers	0.4	0.5	1.3	5.6	74.7	0.4	0.2	0.7
Shipbuilding	1.0	2.0	3.9	0.1	...	0.1	0.8	0.3
Machinery	3.7	3.2	4.7	1.4	0.2	2.6	1.1	1.9
Exports	3.0	9.0	5.6	5.9	13.4	1.2	6.9	6.4
All Other	16.5	5.4	14.9	33.8	6.5	25.7	12.3	32.1
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0



and 1917 had been exceeded.

Structural shapes appear to account for a total of 4,600,000 tons. This compares with 4,096,143 tons, the previous record, made in 1928, a gain of about 12 per cent.

Steel sheets have passed the 6,000,000-ton mark, with an estimated 6,100,000 tons. This is 15 per cent above the previous record, 5,301,401 tons, which was made in 1928.

Tin plate evidently will come close to 2,000,000 tons. The total in the previous year, which was the earlier record, was 1,791,021 tons.

Steel strips are now estimated at 2,500,000 gross tons, which is 16 per cent higher than the previous record of 2,161,988 tons, made in 1928. The present estimated tonnage is double any tonnage made before 1927.

Pipe and tubes show an increase of about 11 per cent over 1928, with an estimated total of 4,439,000 tons, compared with 4,002,837 tons in the preceding year. This again is a new record, exceeding the 4,177,844 tons of 1926, which was the previous high.

WITH Record Outpouring of Steel, Automobiles Held Their Year-old Lead in Steel Consumption. Railroads passed building construction to take second place, as in 1927, having been the leader before that

Distribution of Rolled Steel in 54 Companies Producing 94

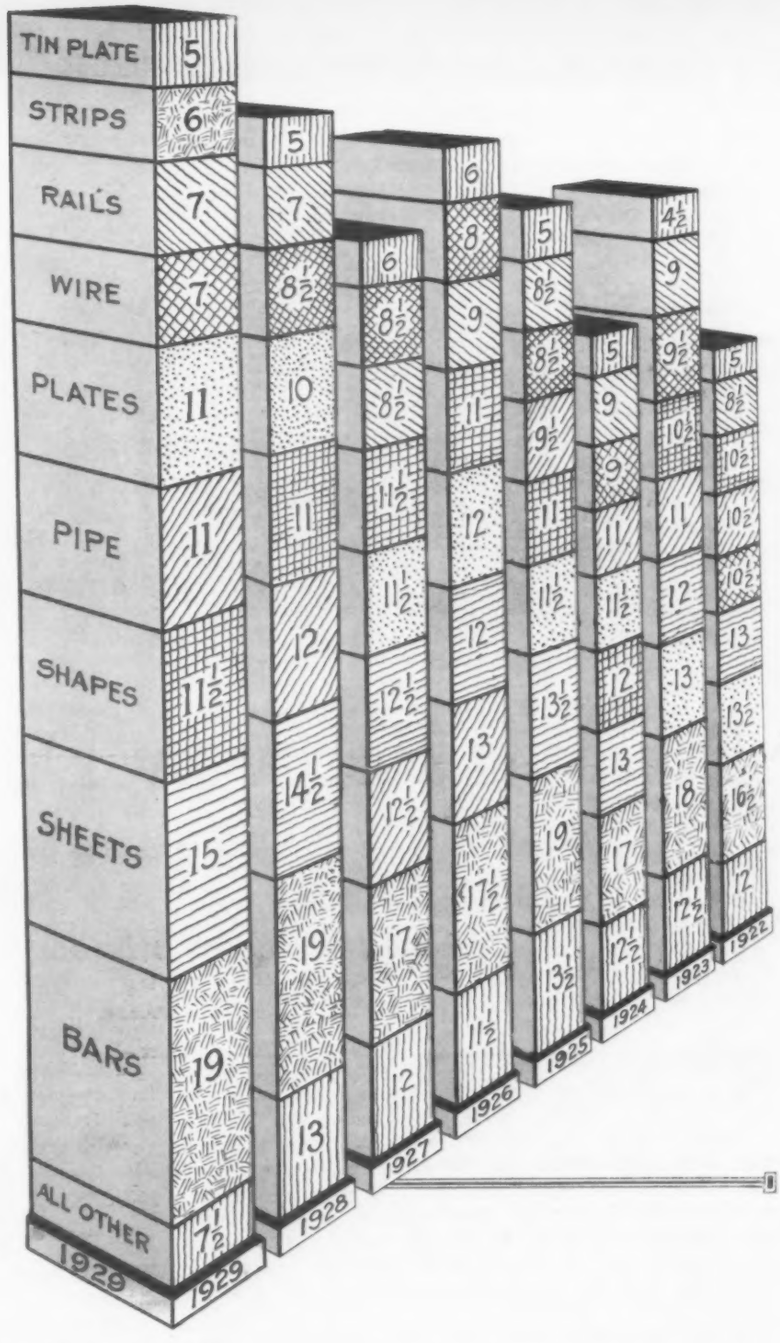
Amount of Each Form Taken, in Thousands

	Heavy Rails	Light Rails	Track Accessories	Structural Plates	Structural Shapes	Bars	Hoops, Bands, Cotton Ties
Railroads (cars and locomotives)	0.1	....	4.1	915.1	441.3	359.4	27.0
Railroads (bldgs. and bridges)	2.1	0.1	0.6	139.0	312.0	67.9	4.7
Railroads (track work)	2,372.6	4.0	867.0	12.7	0.6	18.5	2.8
Fabricators and bldg. contractors	1.9	1.2	0.6	568.3	2,086.2	386.0	15.9
Concrete reinforcing companies	....	....	....	1.1	7.7	428.6	19.2
Bldg. hardware and trim companies	....	....	....	7.6	26.8	43.7	21.4
Automobile and parts mfrs	0.2	0.1	....	212.9	22.3	1,636.4	439.5
Oil, gas and water companies	3.2	4.7	1.4	558.9	57.3	81.3	11.0
Mining and lumber companies	18.4	59.7	17.5	20.8	21.9	17.6	11.4
Agricultural equipment	0.7	0.3	0.2	36.2	26.6	656.9	65.7
Metal containers	....	....	....	2.2	1.8	2.3	48.3
Shipbuilding	....	....	....	141.7	74.6	16.3	0.5
Boiler and tank mfrs	....	....	....	537.9	66.0	31.3	1.7
Machinery and hand tools	0.9	0.8	0.2	85.4	70.9	365.8	12.1
Bolt, nut and rivet makers	....	....	....	0.1	3.8	504.1	6.7
Electrical mfrs	0.1	....	....	58.9	14.3	60.7	13.9
Forgers	0.1	....	0.1	2.0	0.2	245.5	0.1
Pressed and formed metal mfrs	....	....	....	8.0	....	21.1	16.1
Furniture and stove makers	....	....	....	1.4	1.6	14.9	19.8
Jobbers and warehouses	4.6	6.7	17.7	221.7	392.4	467.5	57.2
Exports	119.1	10.2	18.0	230.2	300.0	181.1	30.7
Miscellaneous	13.3	4.8	7.1	373.5	128.1	577.2	73.4
Totals, 48 companies distributed	2,537.9	92.6	934.5	4,135.6	4,056.4	6,184.1	899.1
Six companies, not distributed	....	....	....	....	....	685.0	46.0
Total year's production	**2,610**	**140**	....	**4,400**	**4,600**	**7,700**	....

Steel rails apparently will show an increase of about 4 per cent over 1928, the estimate being 2,750,000 tons, compared with 2,647,493 tons made in the previous year. This is nowhere near a record, as 1906 showed a total of 3,977,887 tons. The most recent figure higher than the 1929 estimate was that of 1927, with 2,806,486 tons.

Steel plates have gone beyond the 1928 total by perhaps 12 per cent. The estimate is 4,400,000 tons, compared with 3,913,628 tons in 1928. Both figures are considerably below the high record of 5,119,908 tons, made in 1918, when the country was putting forth prodigious efforts in building up a merchant fleet to overcome the submarine menace.

Wire products account apparently for 2,850,000 tons. This is the only major item showing a reduction from 1928, when the total, on the wire-rod basis, was reported at 3,080,816 tons. The record was made in 1916, with 3,518,746 tons, a large part of which was made into barbed wire for use in France and other theaters of war.



1929, According to Shipments of Per Cent of the Year's Output

of Gross Tons, by Different Industries

Black Plate for Tinning	All Other Black Plate and Sheets	Tubes and Pipe	Wire Products	Strip Steel	All Other Finished	Billets and Slabs	Sheet and Tin Bars	Wire Rods	Skelp	Totals
....	172.5	43.6	7.8	9.1	199.8	83.3	....	18.9	....	2,282.0
....	6.8	1.5	8.9	....	0.6	12.9	11.4	91.0	....	659.5
....	0.2	1.5	18.4	....	24.7	....	....	....	....	3,323.0
0.4	194.1	52.9	55.2	43.8	26.8	1.0	25.7	16.6	25.3	3,501.9
3.0	....	....	18.9	0.5	10.0	....	....	0.2	....	489.2
....	258.8	43.9	57.7	50.4	....	....	....	....	....	510.3
36.2	1,593.2	46.4	148.0	936.8	30.0	225.3	2.3	35.8	2.2	5,367.6
23.9	94.6	1,563.9	24.5	....	23.6	39.9	....	0.8	54.9	2,543.9
0.4	13.1	7.0	13.7	4.4	14.4	....	....	....	....	220.3
....	199.7	20.9	414.5	21.2	7.4	33.7	1.2	158.4	....	1,643.6
1,417.9	239.2	0.7	11.8	2.8	1.9	6.5	24.8	13.5	....	1,773.7
....	6.3	2.6	0.8	1.0	1.9	20.5	....	2.3	....	268.5
....	84.2	17.0	0.2	0.7	1.4	....	....	....	....	740.4
1.0	43.2	31.0	17.6	38.7	17.6	27.6	....	5.5	....	718.3
....	....	3.7	90.0	0.8	11.1	45.8	....	12.9	....	679.0
....	392.1	73.3	3.4	46.7	12.5	0.2	....	....	....	676.1
....	....	1.5	0.1	0.1	1.5	106.2	....	0.1	....	357.5
4.5	152.4	2.1	0.4	92.4	32.3	0.2	1.6	....	3.8	334.9
12.3	374.1	12.9	55.9	48.6	0.1	....	....	....	....	541.6
54.1	534.7	1,365.5	438.4	34.1	33.7	9.8	....	0.6	....	3,638.7
251.6	327.4	188.3	115.8	11.8	31.5	3.1	9.7	23.4	25.4	1,877.9
97.7	877.5	129.1	473.7	230.0	28.2	161.9	62.1	441.3	520.8	4,199.7
1,903.0	5,564.1	3,609.3	1,975.7	1,573.9	511.0	777.9	138.8	821.3	632.4	36,347.6
....	205.9	66.1	135.0	144.5	37.4	20.0	....	0.7	....	1,340.6
2,000	**6,100**	**4,439**	**2,850**	**2,500**	....	....	....	....	....	**40,333**

NEW High Records Were Made in Six of the Nine Forms of Steel Shown in 1929. Bars easily maintained their lead and sheets increased in ratio, both in response to huge demand from automobile plants



Building Recovery Due By Spring

Record for Year Should Equal and May Exceed That of 1929, Says Economist of S. W. Straus & Co.— Recent Decline Sets Stage for Comeback

BY W. C. CLARK*

SOME economists believe that we are now completing a major business cycle which began in 1921; others, perhaps a majority, contend that the present decline is merely another intermediate recession comparable to that of 1924, which has split the last eight or nine years into two minor cycles of a kind that is likely to be typical of the future. Practically all would agree, however, that the unprecedented prosperity of this recent period has been based upon the stimulus provided by two great industries—building construction and automobile manufacturing.

Originally gaining momentum as a result of a long pent-up demand and then feeding upon the demand caused by the new wealth for which their own activities were primarily responsible, creating a market for the products of the iron and steel and other basic industries and providing employment directly or indirectly in every hamlet throughout the country, these two industries have constituted both the prime mover and the chief support of our recent prosperity. For the time being, however, this fruitful partnership in prosperity seems to have been dissolved.

During 1929, while the building industry has lagged behind, slackening its pace some 12 or 13 per cent, as compared with 1928, the automobile industry has put on an astonishing burst of speed and left all its old records far behind. Today the over-produced condition of this latter industry constitutes perhaps the sorest spot in the entire business, whereas the construction industry is now looked upon as the industry which will save us from business collapse, cushioning the decline in business activity and stimulating the forces of recovery.

Will construction be able to play this role effectively? This is the crucial question which any forecaster of the new year's business must answer.

Favorable and Unfavorable Factors

IN this brief summary we can only touch upon the three important favorable factors, (1) the readjustment which has already taken place in the building industry, (2) the stimulus of easy money, and (3) the prompt and aggressive mobilization, under the inspiration of President Hoover, of the campaign to use construction as a balance wheel of industry. The stimulating effect of these three forces will be somewhat retarded by (1) the loss of savings and paper profits in the stock market debacle, (2) the depletion of funds in the savings banks and building and loan associations, and (3) the fact that supply and demand conditions in some branches of the building industry have not been entirely readjusted.

In the first place, it is clear that the decline in building volume during 1929 has been extremely fortunate. This slowing down has enabled the industry to correct most of the excesses which had developed in the last six or seven years of unprecedented construction activity, but, coinciding as it did with unusual activity in the automobile and many other industries, its depressing effect upon general business was largely counteracted. The readjustment which we are now experiencing in general business may be sharp enough; it would be

*Vice-president and economist of S. W. Straus & Co., New York.

more acute and more protracted had it not been for the year's start gained by the construction industry.

The second favorable factor, easy money, will undoubtedly exert a powerful influence making for the resumption of normal activities in the industry. Comparison of building volume with bond yields, commercial paper rates or other index of the cost of money over the past two years reveals a very high inverse correlation. Cheap money has always been followed, after a lag of a few months, by an upward movement in building volume, whereas rising money rates have either checked expanding activity or brought about a decline. The building decline of the last year or more was due in large part at least to the "tight money" conditions with which even the man on the street is familiar. This tight money, had its earliest and most severe effect upon the building industry. Two factors were responsible for this result. Not only did money become "dear" but for some builders it became practically unavailable. In other words, the irresponsible builder who had managed to operate on a shoestring during the cheap money era found his supply of funds, chiefly for equity purposes, practically cut off. Speculative building, therefore, particularly the small project in the residential field, was the first to feel the pinch. The building industry found it more difficult to evade the effects of difficult borrowing conditions by switching its method of raising capital from funded obligations to capital stock. Real estate stock issues have of course been brought out in increasing number, but the relatively limited earning possibility of a single building did not provide the lure of unlimited profits which the public in its recent mood demanded of its common stock investments. In the industrial and public utility field, stock issues provided an easy means of raising cheap and abundant capital—this helps to explain why industrial building volume increased 15 per cent in the first 11 months of 1929 over 1928 as contrasted with a 30 per cent decline in residential building.

Early Resumption of Building Indicated

THE record-breaking decline in money market rates as a result of the stock market collapse and of Federal Reserve policy, and the resulting improvement in the bond market should make, therefore, for an early resumption of building activity. The effect of this stimulating influence, however, will probably be somewhat retarded by the present cash position of the savings banks and the building and loan associations. These two types of institutions, which have always been important factors in the real estate lending market, particularly in the financing of individual homes and small apartment house and commercial projects, suffered severely, first, from the withdrawal of savings by depositors or shareholders who desired to speculate in stocks, and later by the withdrawal of deposits or the demand for loans upon shares upon the part of such depositors or shareholders who had been caught in the stock market debacle and were attempting to protect their margins. With these withdrawals and loans probably the heaviest in history, it is not likely that these institutions will be able immediately to give vigorous stimulation to the building market. While deposits are already increasing, some months must probably elapse before the normal process of public saving shall have wholly replenished their resources and enabled them to resume real estate lending on a normal scale.

Despite heavy policy loans and a possible slight decline in new life insurance sales, the life insurance companies will probably be both able and willing to continue a normal program of mortgage lending, while the strong real estate bond houses, the title and guaranty companies, and the general market bond houses which have developed a market for real estate securities will continue to lend where supply and demand conditions are in proper balance and, with an improving bond market, will show a substantial improvement in business over 1929.

The third favorable influence is probably the most important of all. For the first time in history we have seen at the very inception of a business recession the prompt mobilization of the business forces of the country in an aggressive campaign designed to minimize incipient unemployment and accelerate the slowing wheels of industry before recession reaches serious proportions. For the first time in history we are seeing a deliberate endeavor made on a far-reaching scale to use the construction industry as the balance wheel of general business—an endeavor, moreover, made by a governmental leader who thoroughly believes in this policy as an instrument of broad economic strategy and who has shown unusual capacity to rally behind him the nation's business leaders. The coming year, therefore, will see an excellent test of the efficacy of this economic instrument — not a perfect test by any means, because the emergency has come upon us before a deliberately planned "prosperity reserve" of public works, etc., had been built up, but still a fairly adequate one because the present leadership is intelligent and aggressive and because the high money rates of the past year have created, in some lines at least, a "natural backlog" of building demand.

Business Psychology Has Changed

SUBSTANTIAL results have already been accomplished. Certainly of no mean importance is the right-about-face in business psychology, the change from the deep gloom so universal during the stock market crash to the general attitude of constructive courage and cautious optimism which prevails at present. Of importance also are the degree of organization among the business and civic authorities of the country which has already been achieved as a result of the Hoover conference at Washington, and the accleration given to the preparation of plans and specifications for major public and private projects.

The direct material benefits in increased construction volume will vary, both as to extent and as to time of emergence, with the different types of construction activity.

Public works, both public buildings and general engineering projects, should show a very substantial and early increase, both because of the public interest involved in the mitigation of unemployment and the greater possibility of long-range planning, and because the improvement in the municipal bond market, already evidenced by a substantial increase in municipal flotations, should make it possible to raise the capital required at reasonable rates. The Federal Government has taken the necessary steps to expand its public building program, the expenditure now contemplated involving $495,000,000 over a 10-year period. The program for 1930 is being pushed with all possible speed. The appeal made by the President for an "energetic but prudent pursuit of public works" by State, municipal and county authorities seems to be meeting with hearty response. As instances of this response, the city of Philadelphia proposes to spend $65,000,000 over the next 18 months, St. Paul has accepted a $15,500,000 schedule of public improvements, and the Governor of Ohio reports that his State is "just now entering upon the greatest building program undertaken in many, many years." Road building will be one of the greatest beneficiaries of this new public works program, an expenditure of over two billions being contemplated for State highway construction, county roads and city streets.

Of great importance will be the speed with which the new work can be initiated. The earlier the program

can be got under way, the more important will be its effect in cushioning the decline and in causing a renewed stimulus to general building and business.

Industial Corporations in Good Position

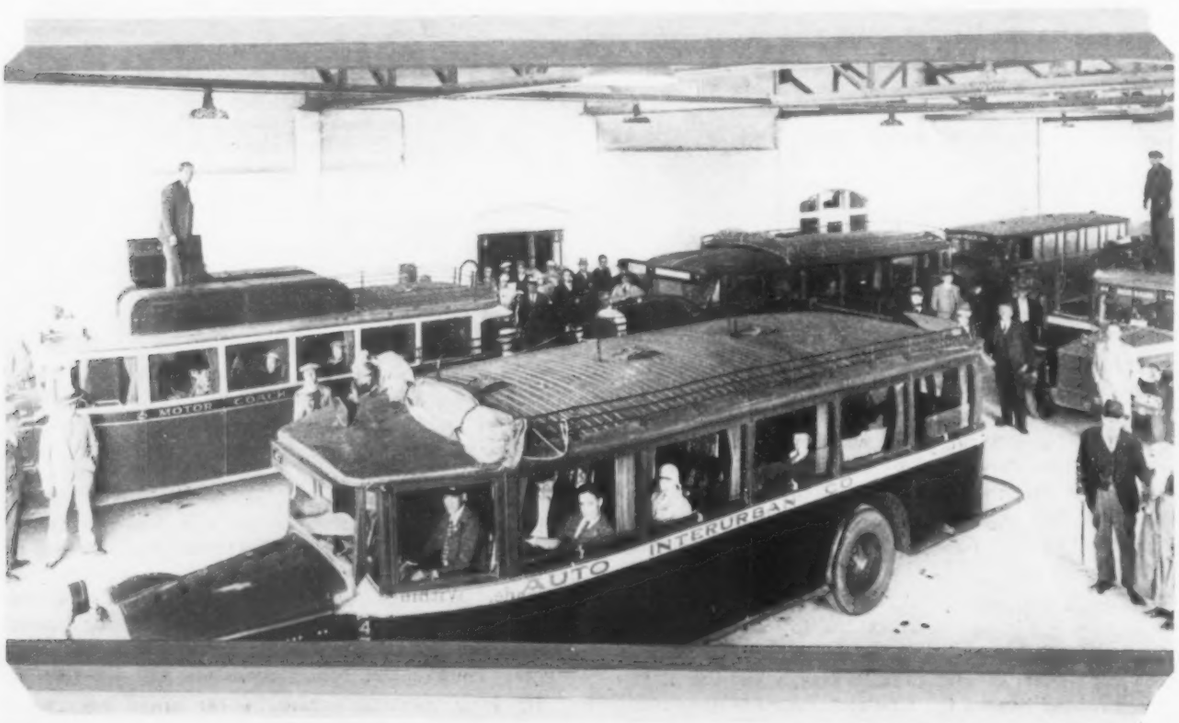
INDUSTRIAL and public utility building will also respond substantially to the new stimulating influences. The rise of new industries and the steady growth of the last few years had already absorbed all or most of the surplus plant capacity created during the war and early postwar years. This fact and the ease of financing by stock issues were responsible for the increase in industrial building during 1929. Today the great industrial corporations are in excellent financial position to go forward with major development projects—their huge cash surpluses and their low ratio of debt to total capitalization enable them to respond to the President's appeal to accelerate their improvement programs. Hence we find the steel industry announcing expenditures "already authorized and definitely planned" of approximately $500,000,000 and the American Telephone & Telegraph Co. proposing to spend for betterments and extensions $700,000,000 during 1930, as compared with $600,000,000 last year, while the electric light and power companies, the manufactured and natural gas companies and the electric railway companies report a decision to go full steam ahead with a construction program of $1,400,000,000, an increase of $110,000,000 over 1929. Railroad budgets for 1930 call for a total capital expenditure of $1,050,000,000, of which $680,000,000 is for roadway and structures.

Residential building construction is not likely to show much, if any, increase over 1929. While the lull in residential building during the past year or more has served to absorb most of the slack in this type of facility, it seems still true that in some cities at least, and particularly in the case of suburban homes and small apartment house projects, supply and demand are not entirely readjusted. Losses by the investor in the stock market will serve to postpone somewhat further the complete absorption of these facilities. Within the city limits of New York, a basis exists for a normal program of residential building. The National Association of Real Estate Boards also reports conditions normal for single family dwellings for 62 per cent of the 411 cities reporting to them and normal for apartments in 55 per cent of such cities. Single family dwellings were overbuilt in 19 per cent of the reporting cities, and underbuilt in 10 per cent; while apartments were overbuilt in 18 per cent and underbuilt in 27 per cent. In the residential field an opportunity exists for a substantial volume of construction in the repair and modernization of existing structures.

Conditions of supply and demand in the commercial field are also, as a whole, not such as to warrant any special stimulation of this type of building. Occupancy conditions are still reasonably healthy in most cities, but the amount of new space coming upon the market in the early future suggests a slowing down rather than an acceleration of this activity. In this connection, however, it is of interest to the steel industry to note that the tendency of real estate development in the central high-land-value sections of our larger cities is in the direction of utilizing larger and larger plots, now frequently entire city blocks, and erecting thereon very large and very tall structures. This trend, chiefly in commercial building, but apparent also in high-grade apartment and apartment hotel projects, is one of the reasons behind the record demand for structural steel shapes during the past year.

Recovery Should Be Apparent by Spring

THE sound conclusion to draw from an analysis of these conflicting forces seems to be that the total volume of construction activity during 1930 will closely approximate that of 1929. January and February, like November and December, will probably be months of sharp decline, but some time during the spring the stimulus of easy money and the pressure of the Hoover stabilization campaign will initiate a recovery which in the late months of the year should reach substantial proportions. In proportion as these two stimulants can be made effective at an early date, the record for the year as a whole will be gratifying. That record is practically certain to be not more than 5 per cent below that of 1929; it is not unlikely that it will equal last year's figure and it may even exceed the latter.



Large Expansion of Motor Bus Transportation Calls for Improved Terminal Facilities

Bus Transportation a Growing Industry

No Branch of the Common Carrier Service Has Expanded So Rapidly and Further Increases Are Expected

BY C. W. STOCKS*

MOTOR buses last year carried two billion passengers over regular routes in city, suburban and inter-city service. The greatest percentage of this movement was in the city and suburban field, where the ride is short, averaging probably not more than three to four miles. To accommodate this patronage, 45,000 buses were required, with approximately 12,000 of them employed in purely local city service. The remainder were engaged in suburban and long-haul inter-city and cross country service. In route mileage these 45,000 buses covered 290,000 miles, more in fact than the total track mileage of the country of both steam and electric roads.

Outside of this group of common carrier buses handling people, not only to and from their places of occupation but to seek enjoyment, are nearly as many that transport children to and from school, that serve hotel and apartment guests, that show the sights of our principal cities and that serve in a variety of other needs calling for transport facilities. While this non-common carrier group approximates in number of vehicles the common carrier group, the business done by them, translated into dollars and cents, or measured in terms of miles operated, is only a small percentage of the entire industry.

It is variously estimated that the common carrier group is now selling close to ten billion passenger miles of service annually, and increasing each year at a rate of 5 per cent or more. The annual revenue approximates $325,000,000. In addition, there are earnings from chartered or private party buses, tours, mail and express, amounting to at least 10 per cent more, giving the industry as at present constituted an earning power of $350,000,000.

Large Expansion in Few Years

THIS is a remarkable growth for less than a decade. In 1922 there were 20,000 buses, a revenue of not more than $110,000,000, a traffic of 850,000,000, a route mileage of 185,000.

These figures indicate that the bus industry has established itself as the country's fastest growing form of transportation service. For another thing, the figures show the existence of a new and rapidly growing market of considerable size. Obviously, a very large portion of all current revenues must be paid out for labor, equipment and operating supplies.

When measured in terms of market possibilities, the bus industry represents at present a buying power of $265,000,000, exclusive of payroll. This divides into $65,000,000 for vehicles and $200,000,000 for maintenance and operating supplies. Analyzed in a different manner, the industry will grow in the future not as in the past, which was entirely from expansion, but through improvements which mean, first, the replacement of vehicles that have grown old in service, better garage and housing facilities and more modern up-to-date shop equipment that will reduce the time that vehicles are tied up in the shops for repairs.

*Editor *Bus Transportation*, New York.

Within the past two or three years maintenance has grown from a corner in the garage to a most important part of the job of bus operation. It is now a highly specialized business and no other single phase of the transportation industry is so conscious of the value of an adequate maintenance program. Such a program constantly demands the use of improved facilities and working conditions for mechanics. The year just closed has seen many new garages constructed to carry on this maintenance program. The industry is maintaining itself, it is becoming independent of outside public service stations, as is shown by purchases of modern machine tools and other shop equipment. Probably 175 garages have been built during the year. More are under way or planned for early construction. Current investment in maintenance facilities, shops, garages and tools, for common carrier buses alone, is now figured as being close to $110,000,000.

City Bus Operations Grow

THE constantly growing popularity of the bus in city transportation service is easily explained. In the cities the bus is proving itself a satisfactory mass transportation vehicle. It has certain advantages to the operator in economy and flexibility lacking in equipment that must operate on fixed rails. Particularly striking is the growth in the number of cities in which buses are the only means of mass transportation. In 1922, only 15 cities with upward of over 10,000 population were served exclusively by buses, while as of Sept. 1, 1929, there were 186 such cities. The number is steadily increasing and will cross the 200 mark early in 1930. But this is not all, for buses are found in local service in connection with electric railways in 357 other cities. In other words, 52.7 per cent of the 1032 municipalities in the United States having 10,000 or more inhabitants either have bus service exclusively or in connection with local electric railway service. In 1922, there were but 192 cities with similar bus services.

In inter-city and long-haul service, the popularity of the bus rests in its ability to offer greater frequency of service or headway, with rates considerably lower than any other organized form of transportation. Backed with adequate terminal facilities and an advertising program this phase of operation has so rapidly developed that it is now possible to purchase an inter-line ticket between almost any two places irrespective of location in the United States. Probably no other one thing has so stimulated long-haul bus travel as the growth of inter-line ticket arrangements between the cross country lines and the shorter distributing lines found in all the States.

In 1922, 40 to 50 miles by bus was a long trip. In fact, it was only in California that trips of that length could be made. Within the past two or three years, cross country transcontinental service has grown from a single operation to a vast network covering the entire country. One company now controls inter-connecting lines from coast to coast and border to border. Other single companies control thousands of miles of route, not to mention the hun-

dreds of shorter lines with traffic agreements feeding into these larger systems. All this has created a demand for passenger terminal facilities, where information, tickets and conveniences can be provided for the bus traveler. Within the past three years the investment in passenger terminal facilities has grown from almost zero to something in the neighborhood of $50,000,000. Scarcely a city of size is now without a union bus terminal.

Bus Designs Have Changed Rapidly

IT is significant that in the past eight years nearly 200 chassis models have come and gone. In this same period 49 manufacturers have retired from the field—some permanently, while others, for the present, at least, are not actively engaged in production.

Developments in vehicle design have also been rapid. The trend has been toward larger buses. During the past eight years conventional type buses have grown in size from a wheelbase of 198 in. to 250 in.—in fact, some are in service with a wheelbase of 265 in. Naturally, these larger vehicles require larger power plants—and engine horsepower has similarly increased from 50 to an average of 125, with one manufacturer putting out a 175-hp. unit. Measured in passenger capacity, it means a 25-passenger bus has grown to 33 or 37 passengers, depending on seating arrangements. In other words, buses have increased in wheelbase 1¼ times, in engine power and speed 2½ times, in seating capacity 1⅓ times, and in performance and dependability 10 times.

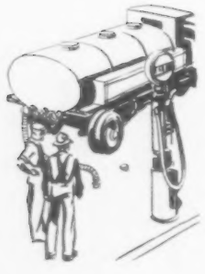
Trend Toward Large Capacity Buses

AS for the types and kinds of buses purchased, an analysis of deliveries indicates that, of the 8500 buses bought by the industry in 1928, 33 per cent were of the light-duty type, 28 per cent of the medium-duty type and 39 per cent were of the heavy-duty or larger capacity type with wheelbases from 220 to 265 in. In terms of weight the light-duty chassis weighs from two to three and one-half tons, the medium duty from four to five tons, and the heavy-duty units from five to six tons. In other words, in the manufacture of chassis for the industry on the basis of 8500 units, 37,300 tons of iron and steel is consumed annually. This is likely to increase in the future because of three factors: greater weight of the chassis units, more steel bodies and growth in the replacement of obsolete units.

Motor Car Demand to Be Less

Automobile Industry Expects to Produce About 4,500,000 Passenger Vehicles and Trucks in 1930—A Slow Start But Good Ending for Year Predicted

BY F. L. PRENTISS*



A PROFITABLE year with reduced production is looked for by the automotive industry during 1930. A number of the leading motor car builders seem inclined to avoid a competitive race for volume output this year and to adjust their production to the normal demand.

The 1929 output of passenger cars and trucks in the United States and Canada was approximately 5,600,000 vehicles. While automobile manufacturers in their estimates of this year's output differ somewhat, all agree that there will be a sharp curtailment in production, and the opinion seems quite general that the 1930 output of passenger cars and trucks will be around 4,500,000. This brings the industry back close to its 1928 record, when 4,600,000 vehicles were produced, and means a curtailment of about 20 per cent as compared with last year.

Automobile manufacturers are taking a rather hopeful view of the prospects and believe that they will be able to make good profits this year, although considerably less than in 1929. With reduced motor car output there will be a corresponding decrease in the demand for steel from that source, and mills are taking this into consideration in estimates for their 1930 business.

The automotive industry will face a buyers' market this year and competition that has never been keener. Competition is expected to be the sharpest in the cars ranging from $1,000 to $2,000. Price reductions during the past few years have resulted from increased output that has lowered production costs. This year a curtailment in production is expected to increase costs, and the year has started with an upward tendency in prices. Already some of the makers of medium and high-priced cars have announced advances. The reason frankly given for these advances is that sales and output will be reduced, necessitating an upward revision of production costs.

Motor car manufacturers which have raised their prices have done so to the extent that they will be able to make a profit on their estimated curtailed production. Cost per unit mounts rather rapidly with decreased output as automobile plants are laid out for a certain production and, to be run with the highest efficiency and economy, must be operated at capacity.

Industry in Strong Financial Position

THE automotive industry as a whole is in a stronger financial position than ever before. With several years of profitable business, good-sized surpluses have been built up and car manufacturers so situated are taking the stand that it is not necessary for them to sell cars at a loss. Instead, they will maintain prices that will allow a fair profit. However, the policy of advancing prices to make their business profitable with reduced pro-

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duction will not be followed by all car builders. One leading manufacturer of models covering a wide range of prices announces that it will hold to its 1929 prices, evidently being willing to take a chance of keeping its 1930 volume sufficiently high to make its business profitable without advancing prices and at the same time not endangering a restriction in its sales because of higher prices. If there are price cuts or distress selling, the lower prices are expected to come from some of the weak manufacturers.

Aside from reduced output, there appears to be no justification for higher prices for motor cars. Prices on forms of steel used in the manufacture of cars are a little lower than a year ago and there is no immediate prospect of an advance. Other commodity prices have been showing a downward tendency.

Two outstanding factors to a considerable measure will affect the 1930 output of motor cars and add to the uncertainty of production estimates of leaders in the industry. One factor is the extent that the Ford Motor Co. will be able to increase its production over its 1929 record. The other is the rapidity with which used cars are moved. In this connection, attention might be called to the fact that, with the output of the Ford company eliminated in both years, about 40,000 fewer passenger cars were built last year than in 1928. The Ford company has an ambitious program of stepping up its production this year to well above that of 1928, or to 2,000,000 or more cars. Whether its goal will be reached will depend, of course, on whether the Ford company can find a market for that number of cars. This company is not in the position it occupied a year ago when the production of its new models had not caught up with the demand.

Stocks of Used Cars Affect Outlook

PRODUCTION this year, according to close students of automobile marketing conditions, will be dependent to a considerable extent on the rate of movement of used cars. Stocks of used cars fluctuate with the sales of new cars, and the large volume of sales of new cars last year brought heavy stocks of used cars to dealers' yards and these have been moving very slowly. In many sections they are a drug on the market and many that have not entirely passed the age of usefulness are finding their way to the scrap yard.

There are about 25,000,000 motor vehicles in use in the United States, and it is estimated that the replacement demand this year will require 3,000,000 new cars. Each year the number required for replacement is increasing rather rapidly. Cars built in 1923, when the industry passed its 4,000,000 mark, are near the end of their usefulness. There are still millions of model "T" Fords which must be replaced.

Changes in Models Probably Fewer in 1930

Automobile sales have been stimulated for several years by both mechanical improvements and changes in body design. While improvements are still being made, they are less spectacular than formerly and trade-ins of cars from one to three years old simply for the sake of getting an up-to-date model may not be as numerous in 1930 as in some previous years.

There were approximately 550,000 motor vehicles exported last year. Exports this year are expected to hold their own with 1929 and perhaps gain a little. American motor cars are retaining their popularity abroad and competing successfully in foreign countries with cars made in those countries in spite of import duties and other restrictions. Excluding estimated exports and replacements and with an estimated production of 4,500,000 units there will be about 1,000,000 to be sold to new buyers.



The second and third quarters are expected to be the peak periods of automobile production this year. There probably will be a slow but steady increase in output during this month and next, but it is doubtful whether the industry gets going in full swing before April. Manufacturers will pay more attention than they did last year to adjusting their production schedules to the normal demand.

Sales were well up to production during the first half of last year. The industry kept up its high production during the latter part of the summer and early fall, maintaining a pace that caused general surprise and bringing the output well beyond early predictions. Without the seasonal slowing down, there was soon evidence of overproduction. Manufacturers found that they had not started to curtail production schedules soon enough. Then came the crash of the stock market, for which the industry was not prepared. Still operating at rather heavy schedules with material and parts rolling in daily by the trainload, the industry could not shut down over night. When it succeeded in making the drastic cut in production that conditions warranted, it found itself as well as its dealers loaded with heavy stocks. Manufacturers' stocks have been well worked off during the past two months, but dealers still have large stocks and these are moving slowly.

Better Distribution Methods Probable

DISTRIBUTION methods are likely to be improved this year. Closer cooperation by the manufacturers and distributers is probable as well as more intelligent sales effort on the part of dealers. With production controlled by the demand, as a number of manufacturers promise, cars will not be forced on dealers in excess of what they can reasonably expect to sell. With reduced sales of new cars, the used car problem will probably be less serious than last year, although dealers still have large stocks of used cars to be disposed of. Last year seemed to have been a year of profitless prosperity with a large share of dealers, who have profits tied up in used cars which they are liquidating with difficulty except at a considerable sacrifice as compared with the trade-in price.

Sales of new cars have often involved several transactions resulting from taking in a fairly good car, to sell which a dealer takes in another of less value, and so on until the last car for which an allowance is made is fit only for the junk heap. The dealer has also suffered from taking in scrapped cars. A prospective buyer acquires a junk car, secures a liberal allowance on it in purchasing a new car, the dealer sells it back to the junk dealer at its scrap value and it again goes around the circle.

Manufacturers of automobile parts also face the problem of reduced production this year, but with increased competition seem to have little chance of getting better prices. Motor car manufacturers as a rule are now showing a disposition to force parts makers to reduce their prices, taking the stand that reduction in prices for parts will affect the prosperity of other industries and react to curtail the buying of automobiles. However, need for orders has resulted recently in some price shading by parts makers. Foundries making malleable castings for automobiles have renewed contracts for the first quarter at the last quarter prices, which they regard as too low for a fair profit.

While there are various factors, some of which are mentioned above, that may affect automobile sales this year, the outstanding factor is general business conditions. The volume of sales will depend on the prosperity of other industries, steady employment and good earnings of car users in all walks of life.



Industrial Building Outstanding in 1929

BY A. W. WELCH*

THE confident prediction of a year ago that engineering construction would maintain in 1929 the high volume level established in recent years was fulfilled. The 1929 contract value was $3,578,580,000; the 1929 value was $4,000,000,000, a gain of 12 per cent. This is in remarkable contrast with the severe decline in residential building due to a current sufficiency of structures in that class and to the increasingly unfavorable attitude of finance toward speculative building.

Contract letting on engineering structures was consistently heavy during the first three quarters of the year, no month reporting less than $300,000,000. Since September the trend has been seasonally down and no unusual rise is to be expected in the next few months.

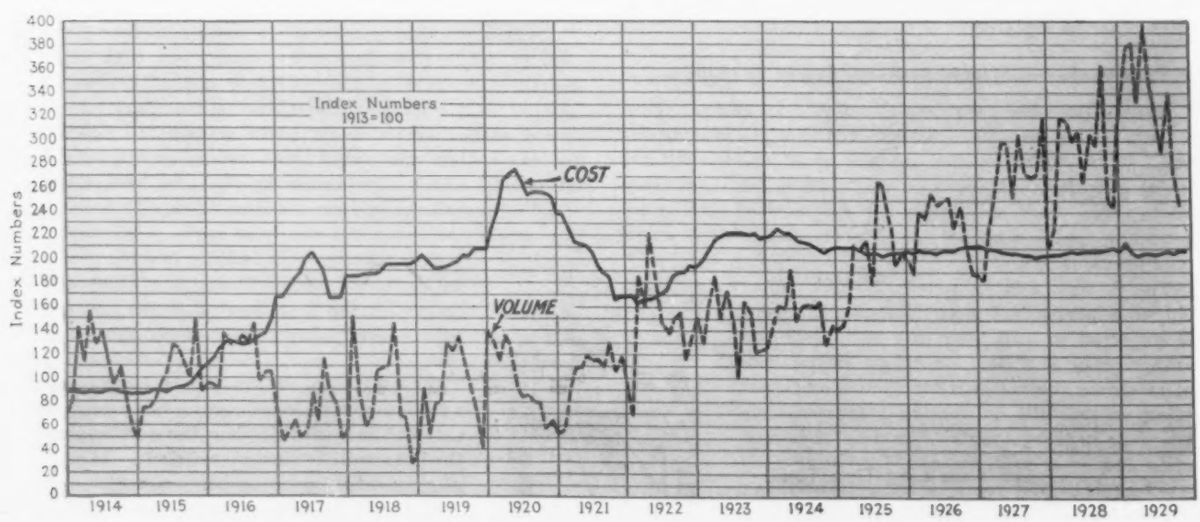
The most spectacular business event of the year, the stock market drop, is expected to have a favorable influence on construction. A nation-wide inquiry addressed to all departments of the industry reveals that this expectation is unanimous and is based on solid facts. The speculative frenzy had carried interest rates to levels that made sound financing of both public and private works difficult. With the removal of the call market lure, it is expected that an adequate volume of money will be available for capital investment and at reasonable interest rates.

Large Gain in Industrial Building

Industrial building activity has been outstanding. In 1928 a gain of 10 per cent was shown. The 1929 gain was 49 per cent. An accompanying table shows the number and value of contracts of $40,000 or more for six industries and the total for 1929 and 1928. It is seen that the gain is in both number and value. Building by the six industries having special iron and steel interests has set a record that may be difficult to equal this year. This represents a distinct spurt, inasmuch as the values for 1928 and 1927 are almost identical. The reason is the award of a comparatively few extraordinarily large contracts. Seven of these alone total $113,000,000.

Volume of bridge construction in the last few years has run remarkably even, in view of the unusually large

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Since 1925 the General Level of Building Costs Has Been Almost Flat

projects that have been launched. Last year both public and private structures exceeded in value those of 1928, total gain being 5 per cent. The 1928 figure included 12 projects totaling $50,000,000. In 1929 there were 12 totaling $33,000,000. The largest was the $11,500,000 structure over Suisun Bay, Cal. Other large bridge contracts were: $3,082,032, over Chicago River; $3,500,000, over San Diego Bay; $2,484,000 over Susquehanna; $2,841,000, over Hackensack.

Stability of Costs a Feature

One of the strongest features of the construction situation is the stability of costs. Since 1925 the general level has been almost flat. This stability is attributable to both materials prices and labor rates. Since 1925 the price trend has been gradually down, with skilled labor rates gradually rising and with common labor fluctuating, but with the long trend flat. These characteristics are expected to continue in 1930 and to contribute their share in strengthening the high confidence already vested in construction.

A Comparison of Industrial Building Contracts

	1929		1928	
	No.	Value	No.	Value
Electric power plants	146	$153,469,000	118	$64,273,000
Automotive	272	26,633,000	244	37,181,000
Machine shops	91	13,869,000	67	10,303,000
Foundries	39	3,867,000	35	4,752,000
Iron and steel products	109	51,934,000	143	19,014,000
Aircraft	31	15,816,000	13	4,361,000
Total	688	$265,588,000	620	$139,884,000
Other industries	1,357	263,160,000	1,052	215,303,000
Grand total	2,045	$528,748,000	1,672	$355,187,000

Bridge Contracts Awarded in 1929 and 1928

	1929	1928
New England	$3,832,000	$7,578,000
Middle Atlantic	36,104,000	35,928,000
South	15,746,000	28,755,000
Mid West	24,648,000	25,976,000
West of Mississippi	30,623,000	20,288,000
Far West	26,523,000	11,678,000
Total	$137,476,000	$130,203,000
Public	$99,297,000	$96,781,000
Private	$38,179,000	$33,422,000

Automobile Production in 1929 Breaks All Records

PRODUCTION of cars and trucks in the United States and Canada in 1929 is estimated at 5,625,000 units. This is practically 1,000,000 vehicles greater than last year's record-breaking output of 4,601,141 cars and trucks. With Canadian production estimated at 265,000 for the year, the total for the United States is about 5,360,000.

Of the grand total, passenger cars have accounted for about 4,800,000 units and trucks for about 825,000 units. Canadian production was not far from last year's total, which was 242,382. American production of 5,360,000 units compares with 4,358,759 made in 1928. The increase in American production has been most marked in trucks, which have gone up more than 40 per cent from the 530,910 trucks made in 1928 to 760,000. Passenger cars have shown a gain of about 19 per cent from the 3,821,136 units of 1928 to 4,600,000 this year.

Two diagrams on this page show the monthly average production for about 15 years for passenger automobiles and motor trucks independently. The dotted line on each diagram represents the long-time trend line as figured out over a term of years ended with 1928. Both curves in 1929 have gone above the trend line, that for the trucks being now far above it.

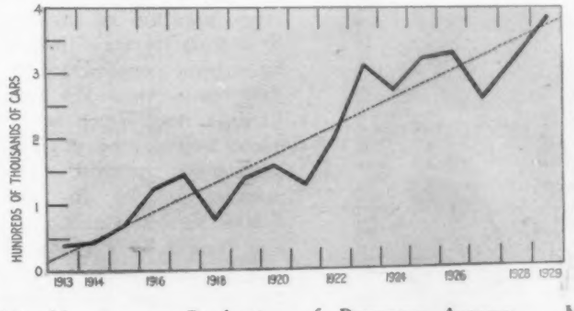
Eighty-seven per cent of all passenger vehicles built in the past year were of the closed-body type, according to preliminary figures gathered by the National Automobile Chamber of Commerce.

The wholesale value of passenger cars made during the year is estimated at $2,950,000,000, and of trucks, $530,000,000. Motor bus transportation growth during the year was continued, with 95,000 buses now in service, of which 11,500 are used as auxiliaries by street railroads and 1900 by steam railroads. Seventy steam railroad companies are at present employing buses.

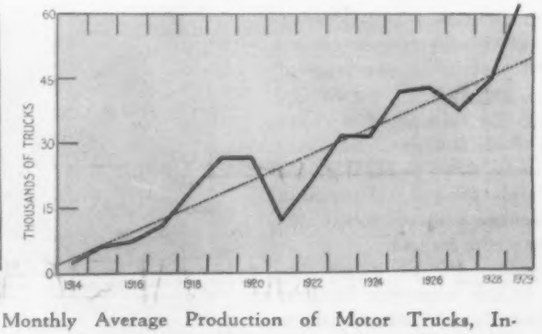
Exports of motor vehicles during the year were stated at 1,018,000 units, valued at $755,000,000. This gives an increase of 23 per cent over the export trade of 1928. Only 710 cars were imported. Exports represented about 18 per cent of the total production in number of cars and about 22 per cent in wholesale value.

During the year the automobile industry used 85 per cent of all the rubber, 67 per cent of the plate glass, 15 per cent of the copper and 80 per cent of the gasoline of the country. Its consumption of steel approached 20 per cent of the total.

Registration of motor vehicles in the United States is about 26,500,000.



Monthly Average Production of Passenger Automobiles in 1929 Was Much the Largest Ever Reached. The Dotted Line Is the Long-Time Trend



Monthly Average Production of Motor Trucks, Including Buses, Shows a Huge Gain Above All Previous Records

Natural Gas Lines Extend 58,000 Miles

Large Expansion of Past Year One of the Most Striking Industrial Developments—Further Extensions Planned

LARGE expansion of natural gas lines was one of the striking industrial developments of the past year. Although the piping of gas from the oil fields of the Southwest has been going on for some years, 1929 ushered in an era of new construction far greater than that of any preceding year. This expansion promises to continue until most of the principal centers of population are supplied with gas from the oil country.

For several months of 1929 the demand for pipe was one of the most stimulating forces toward putting the steel industry of the country on a basis of productivity never before equaled. About 1,000,000 tons of gas pipe alone was contracted for, and a good deal of this was fabricated by the A. O. Smith Corporation, Milwaukee, by its electric welded process. The Milwaukee company was for some time taking steel at the rate of 75,000 tons a month for pipe only.

The country now has about 58,000 miles of natural gas lines, in addition to about 100,000 miles of oil lines. More than $1,750,000,000 is invested in the natural gas industry.

Only a few years ago the transportation of natural gas for a distance of 250 miles was considered a remarkable engineering achievement. Now, lines have been constructed that will carry gas 400 to 500 miles, and one is projected that will deliver it a distance of 1000 miles.

The discovery of new oil fields disclosed great quantities of natural gas, which must be piped to large centers of population or allowed to go to waste. Pipe line engineers and manufacturers of pipe line equipment found the way to transport the gas for greater distances, and this brought about the great development of the past year.

Within another year or two it seems likely that gas from the Southwest will reach the Atlantic seaboard. The only obstacle that remains to the further extension of existing lines is the necessity of making contracts with local gas companies to take the gas in wholesale lots and redistribute it to their customers.

May Promote Growth of Industrial Centers

JUST as the building of oil pipe lines throughout the country made possible the low-cost distribution of oil and gasoline and thereby played an important part in the development of the automobile industry through the furnishing of cheap motor fuel, the gas lines may eventually serve to promote the industrial growth of centers where cheap and convenient natural gas is to be had.

Recently the St. Louis district began receiving natural gas from the oil fields of northern Louisiana. The pipe line built by the Mississippi River Fuel Corporation was one of the outstanding gas line projects of the year. The total distance traversed by the main line, field line and two branch lines is 526 miles.

Of the main line of about 431 miles, extending from Perryville, La., to its terminus just north of the Meramec River, in St. Louis County, Mo., about 300 miles was electric welded pipe and the remainder was lapwelded. All of the main line pipe was 22 in. in diameter. The branch lines consisted of 70 miles of 14, 16, 18, 20 and 22-in. pipe. Lapwelded pipe was used for the field line. About 115,000 tons of steel was used in the main line and 25,000 tons in the feeder lines. More than 90,000 couplings were used for connections. Shipments of various materials totaled 4435 carloads, or 98 trainloads of 45 cars each. Eight river crossings were made to complete this gas line. This is only one of the difficulties in laying gas lines. In building a line in west Texas it was necessary to go through 15 miles of rock.

A pipe line even larger than that of the Mississippi River Fuel Corporation's project is under way in the Southern States, being built by the Southern Natural Gas Corporation. It will carry gas from the Monroe and Richlands fields in Louisiana to Atlanta, Ga. While this is a distance of only 450 miles, the many branches which will be constructed will give this pipe line system a total mileage of 900. The initial award of steel pipe for this line was 130,000 tons, and this included 8000 tons of small diameter feeder lines to be furnished by the Republic Iron & Steel Co., which signalized the entrance of this company into the electrical welded pipe field. The Republic company contracted to furnish its electric welded pipe made by the so-called Johnson process. The Republic development contemplates the production at an early date of electric welded pipe in sizes up to 22 in. diameter, and when this has been accomplished the company will probably become a factor in the furnishing of pipe for pipe lines to a greater extent than heretofore when it had only its lapwelded product to offer.



In prospect for 1930 is a line from Texas to Chicago, lines in Montana and the Dakotas and in Canada, an extension of the Memphis, Tenn., line, completed in 1928, to Chattanooga, and a large program of distributing lines from the main lines which have been constructed in the past year or two. The Texas to Chicago line, which will take about 200,000 tons of pipe, was tentatively awarded a few months ago by the Central States Natural Gas Co., which was formed by a group of oil and gas companies, but about the same time the Henry L. Doherty & Co. interests announced a similar project, and both are now held up awaiting an agreement, which may result in building only one line.

Railroad Equipment Buying Gains

Orders for Cars and Locomotives in 1929 More Than Double Those of Previous Year—Heavier Capital Outlay in 1930 Announced by Carriers

RAILROAD purchases of cars and locomotives in 1929 were more than double those of 1928. Car orders were the largest for any year since 1924.

Cars bought totaled 111,218 for domestic service, including those placed with railroads' own shops, 9899 for Canada and 3023 for export, a total of 124,140.

Only in four years in the past 15 have cars ordered for domestic service been in excess of the 1929 total. In 1916, the total was 170,054; in 1918, 114,113; in 1922, 180,154, and in 1924, 143,728. In every year since 1924, except last year, the aggregate orders were below 100,000. The poorest years were 1921, when 23,346, and 1928, when 51,200 were bought.



Locomotives ordered during the past year totaled 1212 for domestic service, 77 for Canada and 106 for export, 1395 altogether, against 503 ordered for domestic service in 1928, 98 for Canada and 27 for export.

Passenger cars ordered for domestic service also showed a gain, with a total of 2303 for 1929 against 1930 for 1928. Canadian purchases, however, fell off from 334 in 1928 to 122 in 1929. The total of all passenger cars ordered from American shops was 2458, as compared with 2293 in 1928.

Car shops built in 1929 a total of 93,965 freight cars, of which 82,240 were for domestic service, 8557 for Canada and 3168 for export. Some of the cars ordered in 1928 were not built until 1929, so that the car-building companies still carry on their books at the beginning of 1930 a substantial volume of business, which will be augmented considerably during the next few months, if the plans of the railroads, as announced to President Hoover at his recent business conferences, materialize as outlined.

In the final week of 1929, the first of the large equipment inquiries for 1930 placing was announced. This came from the Van Sweringen group of railroads—the Chesapeake & Ohio, Pere Marquette and Hocking Valley—and called for the purchase of 130 locomotives, 11,350 freight cars and 301 items of passenger train equipment. Additional requirements for two other Van Sweringen roads, the Nickel Plate and the Erie, will soon be announced, and the total expenditure for all of the roads of this group will be about $100,000,000.

Other railroads are expected to come into the market during the early part of 1930 for a large amount of new

(*Continued on page 96*)

Railroad Equipment Orders Gain Heavily in 1929

Statistics compiled by Railway Age on railroad equipment ordered and built in 1929 are as follows:

Equipment Ordered

Freight cars for domestic service	111,218
Freight cars for use in Canada	9,899
Freight cars for export	3,023
Total	124,140
Locomotives for domestic service	1,212
Locomotives for use in Canada	77
Locomotives for export	106
Total	1,395
Passenger cars for domestic service	2,303
Passenger cars for use in Canada	122
Passenger cars for export	33
Total	2,458

Equipment Built for Service in the United States

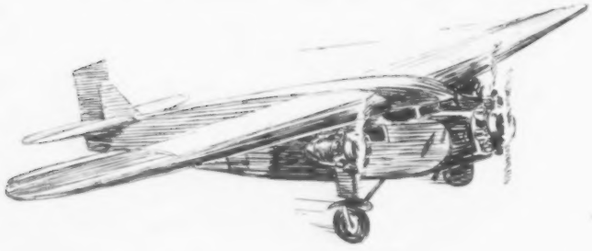
Freight cars	82,240
Locomotives	926
Passenger cars	1,254

Orders for Freight Cars Since 1915

Year	Domestic	Canadian	Export	Total
1915	109,792	.....	18,222	128,014
1916	170,054	.....	35,314	205,368
1917	79,367	.....	53,191	132,558
1918	114,113	9,657	53,547	177,317
1919	22,062	3,837	3,994	29,893
1920	84,207	12,406	9,056	105,669
1921	23,346	30	4,982	28,358
1922	180,154	746	1,072	181,972
1923	94,471	8,685	396	105,552
1924	143,728	1,867	4,017	149,612
1925	92,816	642	2,138	95,596
1926	67,029	1,495	1,971	70,495
1927	72,006	2,133	646	74,785
1928	51,200	8,901	2,530	62,631
1929	111,218	9,899	3,023	124,120

Prior to 1918, Canadian orders included in domestic.

Aviation in Readjustment Era



Despite Rapid Expansion with Consequent Overproduction, Industry Has Made Definite Progress Which Promises a Sound Future

BY CLARENCE M. YOUNG

MANY readers of THE IRON AGE, having witnessed the tremendous growth and rapid development of commercial flying during the past few years, are asking "What is the future of aviation?" It seems fitting, therefore, to discuss a few of the more important high lights of the present aeronautic situation and to study the outlook for 1930.

While civil aviation has been in the making since 1919, it is only during the past three years that it has been undertaken in an organized way and upon a comprehensive schedule. Some idea of the growth of the industry may be had from the fact that in 1921 only 300 aircraft were built in the United States, whereas in 1929 aircraft production had increased to 6000.

Year Has Brought Definite Progress

SUMMARIZING the present situation, it cannot be denied that the industry as a whole is progressing in a suitable manner. During the current readjustment period, however, there seems to exist a tendency in some quarters to overlook the very substantial increases being made by established enterprises, the large number of totally new enterprises, and the inauguration of aerial operations previously only in project. For example, approximately 16,000,000 miles were flown in scheduled operations in the United States during 1929, as against only 10,673,000 in 1928; 85,000 passengers were carried, and 8,000,000 lb. of air mail transported over scheduled airways in 1929, as against 49,000 passengers and 4,000,000 lb. of mail in 1928; and established airway mileage has increased to more than 35,000 miles in 1929, as against 16,000 in 1928. Another fact of major significance which should not be overlooked is that miscellaneous flying in this country has increased from an estimated 18,000,000 miles in 1926 to 30,000,000 miles in 1927, to 60,000,000 miles in 1928, to 125,000,000 miles in 1929. Surely these figures are of especial economic significance.

Moreover, despite the fact that aeronautical exports from the United States for the year 1928 almost equal the combined exports for the three previous years, those for the first half of 1929 exceeded the aggregate for the full year of 1928 by more than 41 per cent, and the year 1930 is expected to show an even greater growth.

Outstanding developments of the past year include the unprecedented linking of airlines with railroads, steamship services, and automobile bus lines; increased aircraft production; and the marked increases registered by all types of aeronautical licenses issued by the Department of Commerce. Further developments during 1929 include the practical application of the "mecaviator," the automatic mechanical robot which flew an airplane from Dayton, Ohio, to Washington; the improvement of the radio range beacon and other instruments for increasing the safety of all types of flying; the earth-girdling flight of the Graf Zeppelin in less than 22 days; the new speed record of more than 328 miles per hr. attained in the Schneider Cup races; the round trip from New York to Los Angeles and return in less than 37 hr. flying time; the epochal flight of Rear Admiral Byrd to the South Pole; and the initiation of construction of the world's largest dirigible.

Scheduled Mileage Unequaled in any Country

DESPITE references to the great air transport lines of Europe—usually made in a comparative way which suggests that the United States may not be keeping pace—it should be remembered that our daily scheduled mileage is now unequaled in any other country in the world. We have night schedules unheard of elsewhere. We have more than 1000 private, commercial, and municipal airports in operation, with an additional 1200 proposed for early construction. We have nearly 15,000 miles of airways which will soon be fully equipped with the most modern aids to air navigation—including intermediate landing fields, beacon lights, radio range beacons, radio communications, teletype installation, and weather service.

In the near future we shall undoubtedly have transcontinental service which will carry us from coast to coast in 24 to 34 hr.; we shall also have, sooner or later, transoceanic service for both passengers and cargo. Meanwhile, the year 1930 will be a period of constructive readjustment, and the aircraft industry will continue its



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progress in a sound, economic way. The substantial manufacturers, of which there are a suitable number, will continue to develop and produce aircraft for a market that is becoming thoroughly discriminating.

Rapid Expansion Brought Overproduction

THE expansion of the aeronautic industry during the past few years has been so rapid that the industry itself could not keep pace with the demands upon it. This naturally brought about the rapid formation of numerous manufacturing units, some of which possessed comparatively limited means both as to personnel and finances. Some of these, perhaps, accorded only secondary consideration to the actual economies of production and marketing—their objective being the immediate production of aircraft of a type for which there was then a popular demand. In consequence, some of these hastily formed organizations have recently experienced more or less serious problems of overproduction. This, however, does not indicate that there is no current demand for aircraft, for there decidedly is. Rather, it indicates that new design and development, combined with a thoroughly discriminating market, have served to make some former types of airplanes less readily marketable.

The result is the obvious one—not at all unlike the experience in other major industries such as automobiles, railroads, and radio—a readjustment upon a premise of sound economics consistent with the immutable law of supply and demand.

A few months ago there were more than 200 individuals, groups, and corporations in the United States claiming to manufacture aircraft, obviously too many, when it is considered that approximately 50 automobile manufacturers are able to supply the nation's demand for some four or five million passenger cars a year. It is only natural that a considerable number will in the ordinary course of events be eliminated—either by consolidation, merger, or withdrawal. Even though an appreciable number of these 200 or more manufacturers were removed in one way or another, however, it would not unfavorably affect the production of well-designed and efficient types of aircraft.

Industry Will Grow in Sound Manner

NOTWITHSTANDING the fact that the year 1930 is to be a period of constructive readjustment, the aircraft industry will continue its progress in a sound, economic way. Some existing services, improperly premised and inconsequential in character, may, of course, be suspended or withdrawn; but others of importance are sure to be added. The substantial manufacturers, of which there are a suitable number, will continue to develop and produce aircraft for a market that has become highly discriminating. The construction of the world's largest dirigible will progress to the point of practical completion. The Department of Commerce will continue its extension of the Federal airways system. New and additional air-mail contracts, will, undoubtedly, be awarded; and a still greater use of air transport services for passengers and merchandise, as well as mail, will be made. These, and other developments of a similar nature, will be carried forward in an orderly fashion.

It is quite evident, therefore, that the outlook is distinctly "promising" for aviation in 1930.

How the Airplane Industry Itself Regards the Outlook



A *MANUFACTURER of supplies and accessories* for aircraft says: "Our recent expansion program costing $100,000 has been undertaken without any fear as to the ultimate growth of the aeronautical industry. We feel that the actual market for commercial aircraft has not even been remotely touched, and that the present position of the airplane manufacturer is wholly due to lack of adequate sales organization capable of overcoming sales resistance, which is bound to be met in marketing a radically new commodity. Manufacturers, in other words, have made plans for extensive production and have actually gone into such production in the belief that a broad, spontaneous demand existed for commercial aircraft. They were led to acquire this assumption by inflated stock speculation and by glamorous dreams presented by press agents. We believe that the present recession is only temporary."

A manufacturer of airplanes says: "We are very much afraid that the market in this country will have difficulty in absorbing all of the cheaper planes that contemplate mass production. It would be a simple matter for this country to produce 40,000 or 50,000 planes in 1930, but an extremely difficult matter to produce 40,000 or 50,000 pilots."

An engine manufacturer says: "We feel that 1930 will be one of the largest years in aeronautics for small commercial planes."

Another engine builder says: "At the present time aircraft production is at low tide. We believe that it will come back to a new peak in 1930, but we believe that this industry will experience a series of peaks and valleys before the production curve is flattened out to the degree that the automobile curve has been flattened. In this process of evolution there are bound to be many manufacturers of airplanes and airplane engines come into the picture and fade out again, but those who have the foresight and the finances to operate on a long range program will undoubtedly be able to show progress in 1930."

One of the largest units of the industry says: "It seems probable that plant facilities of the industry are ample for requirements of the next two or three years. Some of the weaker units may be taken over by the stronger companies."

Another of the important manufacturers says: "The general outlook for this year is, we think, excellent as a whole, although it seems difficult to forecast closely along certain lines. It has apparently been assumed by most of the industry that there exists an unlimited demand for every type of plane. Some are not, of course, so certain of that now, but it will require the actual working out of events this year to secure a basis for reasonable sales forecasts."

An aviation company, says the "Report on the Progress of Civil Aviation for 1928" (London), was formed in Iceland with local capital. With the aid of a small government grant and the use of personnel and material provided by the Deutsche Luft Hansa, mail and passenger services are operated from Reykjavik to Akureyri and Vestmannoërne, and to other places on the island. Travelers between Reykjavik and Akureyri have leaped with one bound from the Middle Ages to modernity, for a journey, normally made on horseback, which used to take nine or ten days, is now made in a little more than two hours.

Much Steel Needed in Road Building

With Hoover Administration Urging Large Expenditures for Public Works, Highway Construction in 1930 May Set New Record



ROAD building in the United States in 1930 will require a considerable tonnage of steel. On account of the fact that many States and municipalities have not completed their programs for the coming year, it is impossible to give a figure closely approximating the actual consumption of steel in the highway construction field. However THE IRON AGE has obtained information by telegraph from State highway commissions and from other authoritative sources and this serves as a sound basis on which to discuss road building plans for the next 12 months.

The federal government is planning a three-year program calling for an increase of 50 per cent in its expenditures for highway aid. It has been spending about $75,000,000 annually for this purpose, but it is now proposed to set aside $125,000,000 in each of the next three years to help the smaller governmental divisions to push forward the building of roads. In order to put this plan into effect, bills authorizing the expenditure have been introduced in both the United States Senate and the House of Representatives.

Highway construction approached its peak in 1928, reported Samuel Eckels of the American Association of State Highway Officials to the National Business Survey Conference in Washington on Dec. 5. It remained about the same in 1929 and indications are that it will resume its upward trend in 1930. Even with these expenditures, stated Mr. Eckels, construction is not keeping pace with traffic demands. In addition to the State programs, including an outlay each year of more than a billion dollars, the counties and cities together are spending in excess of a billion dollars annually on highway construction and maintenance. Mr. Eckels suggested that there be an increase in the amount of federal aid, which acts as a practical incentive for States to augment their appropriations for road construction.

Cement Highways Require Considerable Steel

Five thousand nine hundred and eight miles of State highways were built of cement in 1928, while local county work was only 1145 miles, declares a reliable authority. It is likely that construction in 1930 will run slightly ahead of those figures. For cement roads two types of steel are used: reinforcing mesh, or the plain type, and reinforcing bars. The latter generally are used on troublesome grades or under conditions requiring strong support.

Practice, of course, varies with each State. Pennsylvania, for instance, uses 43,300 lb. of mesh reinforcement or bar mat for every mile of concrete road, as well as 3168 lb. of ½-in. steel dowel bars and 1810 lb. of ⅝-in. bars at the joints in the paving.

Replies that the State highway commissions have made to THE IRON AGE indicate that the 1930 programs will be large, even though some States cannot yet furnish definite information. New Hampshire will build 100 miles of roads for which 600,000 sq. yd. of reinforcing mesh will be needed. Only marginal bars will be bought by Indiana for its 500 miles of hard surface roads to be constructed in the next year. Kentucky will require 7500 tons of reinforcing steel for its highway program, while its neighbor, Tennessee, will buy 6000 tons of bars and 2500 tons of structural steel.

Missouri will carry forward a program for 1348 miles of roads, but no steel estimate is yet available. The same situation is found in Texas, where 2250 miles of roads were completed in 1929 and the 1930 program probably will be about the same as last year's. California will build 314 miles of new roads and will grade and surface 236 miles of existing highways, while West Virginia will expend $11,000,000 for new roads and $3,000,000 for maintenance of its present system. Eighty-three miles of concrete roads is included in the new roads program.

Bridge Construction Program Also Heavy

State bridge construction work in 1930 also will be of impressive proportions and will require much steel. North Carolina will buy 3000 tons of structural steel and 2500 tons of reinforcing bars for bridges; New Hampshire, 500 tons of steel; Maine, 1200 tons of bars and 1750 tons of structural steel and Pennsylvania 10,000 tons of steel. West Virginia will build 12 large bridges during the coming year, but the steel tonnage is not known. California will spend $2,800,000 on bridges, but here again the steel needed is uncertain. Oregon has $1,000,000 set aside for bridges. In Kentucky the consumption of structural steel depends on the toll bridge program. Bids for toll bridge bonds totaling $11,000,000, are to be received on Jan. 6. The bridge cost in Indiana is expected to be $2,500,000.

Some States are confronted by special conditions which leave their 1930 expenditures for roads undetermined. Illinois, for example, is awaiting the outcome of court litigation over the validity of its gasoline tax on which it depends for its road building funds. Ohio also stresses the fact that it is dependent upon its gasoline tax for funds and therefore its construction program is planned after its income from this tax assumes tangible form.

Iowa Analyzes Road Costs

At least one State, namely Iowa, has made public an anaylsis of its road costs. The Iowa State Highway Commission has found that a mile of concrete pavement cost $26,184, of which 52 per cent, or $13,706 goes to labor through various channels. Reinforcing steel for the concrete road costs $850 a mile and from it labor receives $255.

With this definite evidence that the States are getting under way sizable programs and with the Hoover administration giving strong backing to the construction of public work, road building in 1930 may establish a new record. Despite the large expenditures of the past few years, construction still is lagging behind current requirements. This is all the more reason for believing that the coming year will equal or excel the best previous year in road building and that this industry will afford an outlet for a substantial tonnage of steel.

Shipbuilding Expansion in 1930

Government Program Under Mail Contract and Construction Loan Provisions of Jones-White Merchant Marine Act Will Aid American Shipyards



SHIPBUILDING in American yards, which has been considerably stimulated in recent months under the mail contract and construction loan provisions of the Jones - White Merchant Marine Act of 1928, will undergo further expansion in 1930.

The new program, projected as a part of President Hoover's plan of stabilizing industrial activity, calls for the construction of 28 additional ships at a total cost of about $136,500,000. Bids for mail contracts are soon to be taken by the Interdepartmental Mail Contract Committee at Washington.

About $80,000,000 of the above amount is for ships for the North Atlantic service to be built by the United States Lines. Two of these ships will be super-liners of the Leviathan type, estimated to cost about $30,000,000 each, and two others will be cabin liners to cost about $10,000,000 each.

As originally announced by Postmaster General Brown, the Government's shipbuilding program called for the construction of 40 ships aggregating $250,000,000 in cost. Of these, 11 were to be built for North Atlantic service at a cost of about $132,000,000. In shipping circles, this program was believed to be too ambitious, so the program was cut to 28 ships.

Under the mail contracts negotiated shortly after the Merchant Marine Act became a law, provision was made for the construction or the substitution of 37 vessels.

The United States Shipping Board has granted eight loans for the construction of 18 vessels since the Jones-White law of 1928, and contracts for 13 combined passenger and cargo vessels and for five tankers have been awarded shipyards for the building of these vessels for foreign trade.

When the pending mail contracts have been awarded, the way will be paved for the granting of loans for the building of the 28 additional ships in the new program.

While the pending program is the most ambitious ever undertaken by the American shipbuilding industry

New Shipbuilding Program Calls for 28 Ships at Cost of $136,500,000

A tentative outline of the new ship construction which will be required for pending mail contracts is as follows:

UNITED STATES LINES

Four ships, two of 45,000 gross tons each and two of 20,000 gross tons each. The larger ships, which will be of the Leviathan type, are to be completed in the spring of 1934, and the smaller ships in 1935. Estimated total cost for four ships, $80,000,000.

PANAMA MAIL LINE

Two ships of 10,000 gross tons each, to be completed in 1933. Estimated total cost, $6,000,000.

ROOSEVELT STEAMSHIP CO.

Two ships of 8000 gross tons each, to be completed in 1935. Estimated total cost $6,000,000.

UNITED FRUIT CO.

Three ships of 7000 gross tons each, to be completed in 1934. Estimated total cost, $9,000,000.

LYKES BROTHERS STEAMSHIP CO.

Three ships of 5000 tons each, to be completed in 1935. Estimated total cost, $6,000,000.

GRACE LINE

Five ships, three of 5000 gross tons each and two of 4000 tons each, to be completed in 1933. Estimated total cost, $12,000,000.

COLUMBIAN STEAMSHIP CO.

Three ships of 5000 gross tons each, one to be completed in 1933, another in 1934 and the third in 1935. Estimated total cost, $6,000,000.

MUNSON STEAMSHIP CO.

Two ships of 4900 tons each, one to be completed in 1934 and the other in 1935. Estimated total cost, $3,000,000.

GULF WEST MEDITERRANEAN LINE

Two ships of 5000 tons each, to be completed in 1933. Estimated total cost, $3,500,000.

AMERICAN EXPORT LINES

Two ships of 8000 tons each, to be completed in 1935. Estimated total cost, $4,500,000.

except in war times, shipping experts declare that there is no doubt of the ability of the yards to turn out all of the ships within the required time. Neither is there any doubt as to their success in turning out the super-liners of the 45,000 gross ton type to be built by the United States Lines and which will rival such steamships as the Leviathan, Bremen and others of that class. The Newport News Shipbuilding & Dry Dock Co. recently completed the steamship Pennsylvania, a 22,000 gross ton ship, which is not only the largest merchantman ever built in an American shipyard but also the world's biggest commercial vessel propelled by turbo-electric drive. The Pennsylvania, built for the International Mercantile Marine Co., began regular service between New York and San Francisco last October. While the United States has never constructed commercial vessels larger than the Pennsylvania, it has constructed two airplane carriers each in excess of 40,000 tons displacement when fully loaded and nearly 900 ft. in length.

SINCE May 1, 1929, new contracts for ships involving a total cost of about $76,300,000 have been signed, or about three times the volume in the preceding comparable period. Of the $76,300,000, 25 sea-going merchant vessels represented about $65,300,000, and the remaining $11,000,000 was for the building of 48 small commercial vessels of miscellaneous types. Within the past several months two contracts for the building of naval vessels in private shipyards were closed, the total cost being about $21,000,000.

During the 12 months ended Nov. 1, last, the total contract cost of merchant vessels awarded was $101,600,000, and, with the $21,000,000 for naval vessels, the grand total was $122,600,000.

Recent Contracts for Large Ships

THE principal shipbuilding contracts which the leading American shipyards have recently taken are given in the following list:

NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.

Two ships for Dollar Line, 23,000 gross tons each.
Two ships for the Ward Line, 11,300 gross tons each.

NEW YORK SHIPBUILDING CORPORATION

Four ships for Export Steamship Corporation, 8200 gross tons each.
One ship for Grace Line, 8000 gross tons.

FEDERAL SHIPBUILDING CO.

Two ships for Standard Shipping Co., 15,000 gross tons each.

BETHLEHEM SHIPBUILDING CORPORATION

Two ships for Matson Navigation Co., 18,750 gross tons each.
One ship for Porto Rico Line, 7000 gross tons.
Two oil tankers for Sinclair Oil Co., 6100 tons each.

SUN SHIPBUILDING CO.

Five tankers for Motor Tanker Corporation, 9000 gross tons each.
Two tankers for Tidewater Oil Co., 9000 gross tons each.
Two tankers for Standard Shipping Co., 9000 gross tons each.
Two tankers for Sun Oil Co., 9000 gross tons each.

Increase Largely in Ocean-Going Ships

This increase in shipbuilding in the past year, according to H. G. Smith, president, National Council of American Shipbuilders, 11 Broadway, New York, has been confined almost entirely to ocean-going merchant vessels and yachts, and the increase is due exclusively to the aid afforded ship owners by the mail contract provision of the Merchant Marine Act and to the construction loan fund created by the act. The increase in the building of private yachts is due to the tariff protection afforded American shipbuilders under the Tariff Act of 1928, which imposed a 30 per cent ad valorem duty on yachts built in foreign shipyards for American owners.

"Although business has increased in the large shipyards on the Atlantic Coast," said Mr. Smith, "the shipyards equipped for the building of small vessels and miscellaneous craft, except those engaged in building yachts, have shown no improved business condition. They require new contracts to enable them to operate normally." Mr. Smith points out that demands upon many of the smaller shipyards for barges and other small craft will increase as progress is made in the development of inland waterways.

Mr. Smith estimates that at least $75,000,000 worth of shipbuilding contracts annually are necessary to keep the American shipbuilding industry profitably active.

FOR many years the shipbuilding industry has been operating at a sub-normal rate, with consequent loss of a large number of skilled workmen. The shipyards can absorb 10,000 additional workmen and still be operating at less than normal capacity and without interfering with their ability to undertake the constuction of new naval vessels, Mr. Smith said. There are ample mechanical facilities, including not less than 30 unassigned building ways, so there is no danger that shipbuilding work will be expanded beyond the capacities of the yards. The only limitation on output, as before stated, is the necessity for recruiting skilled labor.

Obsolescence of ships is a factor which may within the next few years restore American shipbuilding to the place it occupied before the war. "With few exceptions, all of the cargo ships now operating under the American flag in both foreign and coastwise trade are 10 years or more of age," said Mr. Smith. "By reason of depreciation, casualty and obsolescence, the average life of a vessel is 20 years, so that the existing cargo fleet should be replaced or extensively rebuilt within the next 10 years to enable it to operate effectively. Such replacement will involve an expenditure of not less than $500,000,000. The replacement of this fleet of cargo vessels has been delayed because of the existence of the idle and unsold Shipping Board vessels built during the war, many of which have been purchased at low prices, although they may not be at all suitable for the requirements of the trade in which they are used."

Further Aid Necessary for Cargo Ships

Mr. Smith says that further Government aid is necessary to encourage the building of cargo ships. This involves a somewhat different situation as cargo ships cannot benefit from the mail contract provision of the Merchant Marine Act, but may be accomplished by lending a larger percentage of first cost from the construction loan fund, by waiving interest during the period of construction or by deferring payment of interest for a period after completion of a cargo vessel. He adds that the replacement of the existing fleet of cargo ships is one of the problems confronting the ship owner and shipbuilder, and the prosperity of the American shipbuilding industry during the next decade will depend to a large extent upon a successful solution.

International Outlook in Steel

Selling Groups Abroad Regarded as Likely to Bolster Prices, and Conditions Appear to Favor Continued American Activity

BY DR. JULIUS KLEIN*



AS 1929 draws to a close we find the European iron and steel markets displaying many different trends. The French industry, supported by an unusual degree of activity among the domestic consuming industries, is operating at a very high level for the season and, across the Channel, the British industry is closing one of its best years since the war. The German industry is, perhaps, not so favorably situated, but, even there, there seems to be some sign of improved activity in the export market. The Belgian-Luxemburg industry, however, is not quite so well off, and export sales have not kept pace in the closing months of the year with the high levels set over the first six months.

Cartels Get New Lease of Life

There can be but little doubt that world consumption of steel slackened somewhat in the closing months of 1929 and that, as a consequence, export prices became somewhat depressed. It seems equally obvious, however, that this condition did not reach an aggravated state and that the 10 per cent reduction in the tonnage program of the Continental Steel Entente which became effective Nov. 1 has done much toward relieving the situation while at the same time distinctly strengthening the position and prestige of the Entente and of cartels generally.

The reaction to this decrease was remarkably rapid and the outlook for the export trade generally brightened perceptibly, but it is of course too early to say whether this present reduction will prove sufficient to cope with the situation. Whether this is the case or whether a further curtailment in the quota will be required, the fact remains that the effect of the Nov. 1 reduction was distinctly salutary, so that further reductions, if required, may be expected to prove similarly beneficial to the tone of the steel export trade.

Four Selling Group Cartels Proposed

Current trade reports indicate that the present production-controlling Continental Steel Entente may be fortified with a series of sales cartels—the present plans of the Entente calling for the erection of four identical groups composed respectively of the industries of Germany and the Saar; Belgium and Luxemburg; France; and the central European industries of Czechoslovakia, Austria and Hungary. These cartels, it is planned, will direct the export sales of all plants embraced in the present Entente, will apportion orders on the basis of the 1929 export activity, and will maintain export prices as firmly as possible.

This plan, although it is believed to have met with the approval of the entire membership, has not yet been adopted, but, according to some European comment, it should, upon its adoption (a circumstance which seems almost within the realms of certainty), do much to lift the level of world prices and to maintain them at higher average levels.

It is quite certain, further, that the efforts of these groups toward maintaining a high level of export prices will be coordinated with those of the Entente proper directed toward the regulation of production to demand, with the objective, of course, of strengthening the tone of the general export market.

Loss of Markets Through Foreign Expansion

The American steel industry will do well to keep in close touch with the development and expansion of productive capacity in some of the lesser producing states—not that any of these is likely to rise suddenly to a commanding position and overshadow any of the present major industries, but because in the course of expanding these lesser industries the existing export markets in their territories are in process of curtailment.

I speak especially of the Japanese, the Australian, and the South African industries, although these are by no means the only instances in which material and steady expansion is taking place, that will soon begin to cut into the volume of their foreign purchases of steel.

The solution for the problems arising from the partial loss of these markets is not difficult to see; in my opinion, it lies in concentrating sales effort on those products which either are not produced at all or which are not being produced in sufficient quantities to meet local demand. It appears highly probable that if any one of these areas can obtain a steady and reliable supply of any one product from some foreign source—products of



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unvarying high quality—that country will not attempt to establish a local industry in competition, but will rather direct its efforts along lines likely to supplement the existing import trade in those products which have proved most suitable to local needs and most thoroughly reliable.

American Exports Will Remain Active

With respect to the outlook for the American iron and steel industry in export trade in 1930, I can only say that I look for it to enjoy much the same degree of prosperous activity which has marked its course in 1928 and 1929. There will, of course be those markets in which a combination of circumstances will bring about a reduction in total sales, but the place which the American product has carved in the world's export markets—carved with the strong tools of high quality and unexcelled service—is too deep for any passing trend to bring about a dislodgement.

I do look for the American industry to be called upon to put forth stronger efforts in the course of its sales activity abroad in 1930 than it has been called upon to do in the past. This I base upon the fact of the very probable formation of the sales cartels as adjuncts to the Continental Steel Entente. The major part of the European industry will thereby be placed in a position to act as a unit. But I do not look for any but a happy outcome—the formation of these cartels with the attendant elimination of the present competitive condition, so far as the export sales of the member countries are concerned, cannot but raise the general level of world prices and thus bring the prices asked for Continental steel products nearer to a parity with those of the American industry. With this the two strong tools of the American industry—high quality of product and of service—will take on renewed sharpness and the position of the American product in world markets will become doubly secure.

Jobbers Improve Their Position

With Growing Emphasis on Service and Profits Rather Than Volume, Warehouse Distributers of Steel Have Better Established Themselves

BY T. H. GERKEN*

IN the early years of the past decade many persons were seriously questioning the economic need for the steel jobber or distributer. With improved railroad service and the definite establishment of hand-to-mouth buying as a permanent industrial policy, very small users of steel found themselves able to buy directly from the mills, often at a better price than the jobber was able to offer, and many times with equivalent or better service. The prosperity of the iron and steel warehouse business was seriously threatened, and it was not until two or three years ago that the jobbing industry began to realize the seriousness of the situation and take steps to change it. The changes undertaken in the two or three years just past have been radical and far reaching. But the year just closed has proved conclusively that the iron and steel warehouse fills a very important need and is here to stay and prosper. The steel jobber now fully realizes that his function is to sell and distribute steel and that his profits are to be made in this manner rather than in speculative buying in anticipation of periods of very heavy demand.

In 1929 more was accomplished than in any previous year toward reaching an understanding with the mills on the distribution of tonnage. Leading jobbers found the mills receptive to plans which might bring about an allocation of business on a basis favorable both to the consumer and producer, and last year the adoption of quantity differentials on many products returned much business to the warehouses which had recently been handled by the mills direct. The plan of setting up quantity differentials is not new, but it had not before been given such widespread use. Such products as cold-finished steel bars, strip steel and others the consumer may now buy in small quantities from the warehouse more cheaply than he could from the mills, and at the same time he is assured prompt delivery at all times. Although the establishment of quantity differentials is by no means effective on a full range of products sold by the warehouse, the success of the plan seems assured and likely to receive wider adoption in the future.

During the year the bolt, nut and rivet industry operated successfully under the so-called Graham plan of distribution, the dominant features of which have been outlined before in these pages. The plan has not been widely adopted by other manufacturers, probably because of certain legal questions which will probably be settled in a trade practice conference during the present year.

Cutting Charges Eliminate Losses

A TROUBLESOME question which was largely settled during 1929 was that of cutting charges. Jobbers had not been able to agree as to a proper charge for cutting steel products to size and shape and this service was being rendered in many warehouses at a loss financially. Last year this question was discussed by jobbers' committees in all parts of the country and a scale of charges was adopted which has met with favor in all the districts in which it has been introduced. These charges have been figured on a scientific basis which provides ample profit for the warehouse and gives the customer definite assurance as to the amount he must pay and also that this amount will be constant. By the end of the first quarter of 1930, the jobbing industry expects to eliminate cutting charges from the list of its ills which have been attacked and cured.

The price structure in 1929 achieved more stability than it has in any recent year. Ruthless cutting was less common and the margin of profit was somewhat higher than before. Early in the year a new set of differentials on cold-rolled strip steel was set up which eliminated many previous price discrepancies, and in July the cold-

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finished bar makers took similar action. In the early part of the year irregularities occurred in the maintenance of re-sale prices on pipe, but these were largely ironed out. A few manufacturers of pipe announced that they would refuse to sell their product to distributers who persisted in this practice and this action proved beneficial to both manufacturers and competing jobbers. Sheet prices were unstable in some parts of the country, but this was interpreted as being largely a reflection of the weakness of mill prices. Nails and wire also showed price irregularity in some districts, although mills made an effort to maintain the 10c. per 100 lb. differential between large jobbers and the general trade which was introduced in the previous year.

Slight confusion also occurred in some localities as a result of the reduced discount on sheets which was introduced in 1928. When the jobbers' discount was lowered from 2 per cent to one-half of 1 per cent, small jobbers who were unable to pass this increase on to their customers suffered financially. However, the situation is now more generally acceptable than it was a year ago, and the jobbing trade has accommodated itself to the new conditions.

Volume of Business Gains Over 1928

AGGREGATE business during the year was generally ahead of that of 1928. In some cases, the increase was as much as 30 per cent, and the average for the industry probably is between 20 and 25 per cent. Business dropped off rather sharply in November, but the first 10 months of the year established many records. In the last two months, efforts have been made to reduce inventories and jobbers' stocks at the end of the year were considerably under those of December, 1928.

Among the industries served by the warehouse, the building trades alone showed any substantial decrease from 1928. Jobbers benefitted to quite a large extent from the smaller airplane manufacturers, but the tendency toward mergers in this field indicates that much of this business will eventually be transferred to the mills. The radio industry was a large consumer of warehouse products. Business was generally satisfactory in the agricultural sections, but showed no substantial gain over the previous year. In the oil country only moderate activity was reported.

Foreign competition in the Atlantic and Gulf cities was less pronounced. The uncertainty of deliveries and doubtful quality of some of the steel shipped from abroad gave much business to domestic products. Some lines of imported materials are being handled successfully by jobbers in this country, but usually they do not compete directly with the American mills. Some talk was heard urging domestic producers to refuse to sell material to distributers who handle imported products in competition, but this agitation was not as pronounced as it had been, and most makers and jobbers are now willing to meet such competition on an equal basis.

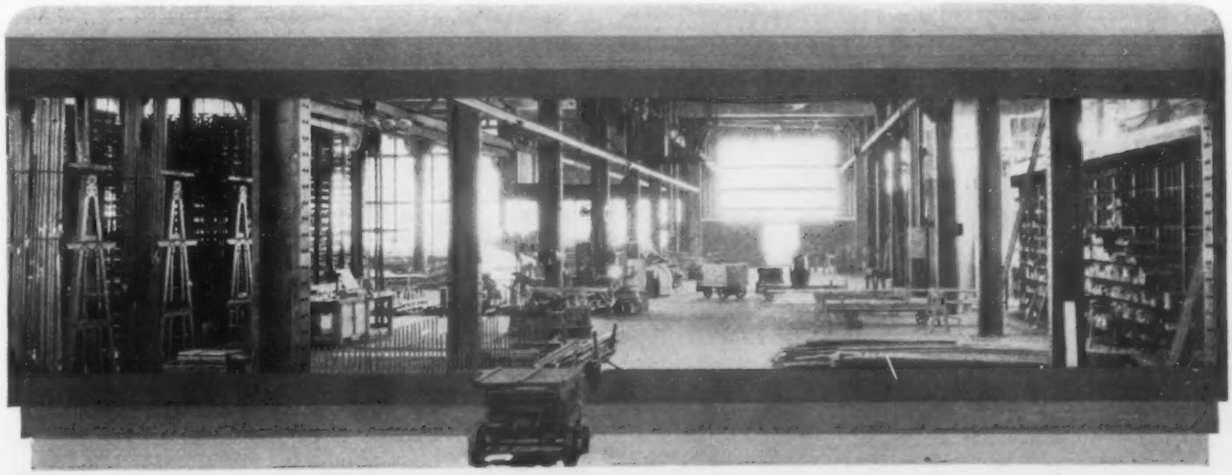
Growing Tendency Toward Consolidations

THE year saw a number of important consolidations in the warehouse field. In some cases this represented further expansion into new districts by large companies operating warehouses in several cities. All of the prominent chain systems extended their businesses into at least one new district during the year, and the industry is undoubtedly to undergo further concentration of this nature. In other cases, consolidations were the result of competition in single districts and the bringing of two or more companies together resulted in better stabilized business. One of the large steel companies extended its warehouse business into the Detroit territory and others made extensions to their facilities in territory in which they were already established. Water shipments to warehouses on the Ohio and Mississippi rivers increased.

Jobbers generally extended and enlarged their motor truck deliveries in all parts of the country. One company even utilized air service in a few cases to speed up delivery, and the possibilities of air transportation in the shipments of lighter products in small quantities were fully illustrated. However, movement of goods in this way will necessarily be limited very sharply by the expense, and will be resorted to only in special cases. It proves, nevertheless, that jobbers fully realize the value of emphasizing their willingness to provide service of the most complete sort at all times.

Emphasis on Profit Rather Than Volume

THE year enabled jobbers to improve their position in the industry materially on account of heavy rolling mill schedules which prevailed in the spring and summer months and the inability of mills to make prompt shipments to smaller customers. Although the opposite condition prevailed in the last two months of the year, business gained earlier in the year was not lost to any marked degree and the warehouse industry enters 1930 in a rather optimistic frame of mind. Although some jobbers expect a slightly smaller volume of business than they secured in the year just past, they expect to suffer no corresponding loss of profit on account of the progress which has been made to place the industry on a firmer financial basis. With emphasis on the margin of profit rather than volume, the prospect of the new year is undoubtedly favorable and a growing number of jobbers are adopting this policy.



Farmer Buying Power Increases

Net Income of Agriculturist Has Been Gaining—Farm Marketing Act Causes Return of Confidence—Implement Industry Active

BY L. W. MOFFETT



RECOGNITION by industry of the importance of agricultural prosperity has become widespread. Agriculture represents the greatest potential purchasing power in the nation. Unless the economic position of the farming community is healthy the manufacturers of iron and steel, machinery and every other product are losing business. The fact has been brought home to industrialists in an emphatic manner by discussion of the farm problem in Congress and throughout the land. It has been made plain that the farmer has been compelled to neglect improvements, repairs and capital equipment to such an extent that, according to agricultural organizations, literally billions of dollars will flow to industry from agriculture when rural purchasing power will warrant it.

This point was brought before the National Business Survey Conference held on Dec. 5 in Washington under the auspices of the Chamber of Commerce of the United States at the request of President Hoover. That agriculture was represented at the gathering was regarded by the farmer associations as "tremendously significant." It was interpreted as marking a day of new relationships. It indicated, in their estimation, a recognition on the part of Government and industry of the economic importance of sound agriculture as an essential producing and consuming group.

Happily the economic position of agriculture has improved. President Hoover in his message to Congress in December said as much. It has been so reported by Secretary of Agriculture Arthur M. Hyde, by agricultural interests themselves and by other authorities. The President said that the gross farm income, as estimated by the Department of Agriculture, was $12,100,000,000 for the crop season of 1926-27; $12,300,000,000 for 1927-28; $12,500,000,000 for 1928-29; and, estimated on the basis of prices since the last harvest, would be over $12,650,000,000 for 1929-30. He declared that the slight decline in general commodity prices during the past few years has naturally bettered the farmers' buying power.

Farmers Regain Confidence

"The number of farmer bankruptcies is very materially decreased below previous years," said the President. "The decline in land values now seems to be arrested and the rate of movement from the farm to the city has been reduced. Not all sections of agriculture, of course, have fared equally, and some areas have suffered from drought. Responsible farm leaders have assured me that a large measure of confidence is returning to agriculture and that a feeling of optimism pervades that industry."

The farm organizations represented at the business survey conference ascribed this new confidence to the recognition of a policy for agriculture and, at the same time, the growth of harmony and teamwork among all organized forces of the nation.

The President, as have others, emphasized the significance of the farm marketing act passed by Congress last June and referred to the measure as representing the most far-reaching step to strengthen agriculture ever taken by any government. According to the farm organizations, the attitude of all the forces of the nation in supporting the act is the best assurance that the American farmer will be able more largely to control the products of his own toil. Confidence has been further inspired by the fact that agriculture itself is recognizing the necessity of thorough organization and more effective cooperation with other forces contributing to national prosperity and welfare.

The farm organizations, however, stated that the slightly increased net income to American farmers, as evidenced by the report of the Secretary of Agriculture, does not justify an over-optimistic statement about agriculture for the year just passed, but added:

"The further belief that agriculture, industry, finance, commerce and the forces of Government jointly can materially relieve the disadvantages under which the American farmer has been working and make it possible for his net income to be sufficiently increased to improve his standard of living, to permit a better rural life and to increase his purchasing power, is a sound basis for renewed hope and courage in the hearts of American farmers.

"We give the assurance that agriculture has this difference from some other groups in that every added dollar received by the farmer will be invested in the products of industry and instantly add to the volume of trade and employment of labor."

Farm Equipment Outlook Good

Similar views were voiced at the conference by the National Association of Farm Equipment Manufacturers through A. E. McKinstry, vice-president, International Harvester Co. He explained that the farm implement industry had been prosperous in 1929 and that, so far as the association could see, it should continue so, generally speaking, for 1930. It was declared that the association did not believe that the deflation in the stock market has had, or is likely to have, any particular direct influence on the farm implement business. The farmer, it was stated, did not speculate in the recent market.

"He took his deflation in 1920," it was stated, "and since that time he has been gradually improving, and our industry, to the extent of its ability, has tried to furnish him with equipment that would make it possible for him to meet the situation and reduce his costs of production."

Mr. McKinstry said that the implement industry will have to make some revision in its schedule due to some unfortunate crop conditions in the Northwest, western

Canada, Argentina and Australia, but, generally, aside from readjustments, it was predicted that 1930 will be as successful as 1929 was.

The Farm Board's Function

The marketing act is still new, but, as has been pointed out by President Hoover, it has already resulted in definite steps toward more efficient organization of agriculture, toward the elimination of waste in marketing and toward the upbuilding of farmers' marketing associations on sounder and more efficient lines. It is the purpose of the Federal Farm Board, with an authorized revolving fund of $500,000,000, of which $150,000,000 has been appropriated, to get cooperative agencies handling various farm products to form centralized national selling organizations, with a view to giving the farmer "bargaining" power when he meets prospective purchasers. It is also the purpose to put the farmer in a position to market his products over certain periods in orderly fashion, to adjust supply to demand and, quoting from the act, "to place agriculture on a basis of economic equality with other industries."

Members of cooperative agricultural organizations will be encouraged to produce not only the kind of products in demand but also to balance the supply. Thus the farmers will be made familiar with the significance of the "business cycle," "peaks" and "valleys," "seasonal influences," etc., subjects which have been the object of intensive study by most other industries since the World War. It has been pointed out by Samuel R. McKelvie, member of the Federal Farm Board, that, despite the fact that about one-third of the farm products of the United States are handled cooperatively, the farmer deals in small units without adequate coordination of his efforts as to grading and distribution, and without credit facilities to encompass a program of orderly action.

The act provides that money may be lent to farmers' cooperative associations by the board, under certain limitations, for the purpose or erection of physical facilities and that loans may also be made for the financing of commodities in the ordinary process of marketing. In the matter of loans for the marketing of commodities, the board interprets the act to mean that it is not intended to supplant services now rendered to cooperative associations by private banking institutions and the Federal intermediate credit banks. It is held to be logical to expect that cooperatives will exhaust the lines of credit which may be obtained at reasonable rates from these other institutions before coming to the board for assistance. The rate of interest on the loans is fixed at within one-eighth of 1 per cent of the rate that the Government pays on its obligations, and in no case shall it exceed 4 per cent.

Grain and Wool Cooperatives Formed

So far two national commodity cooperative sales agencies have been organized under the guidance of the Farm Board—the Farmers' National Grain Corporation, capitalized at $10,000,000, with headquarters in Chicago, organized on Oct. 29, and the National Wool Marketing Corporation, capitalized at $1,000,000, organized Dec. 17, with headquarters at Washington. Two other national organizations, cotton and livestock, are in the process of being organized, and others are in contemplation.

The program of the first organization set-up, the Farmers' National Grain Corporation, provides a good index as to what may be expected through the aid of the Farm Board. The corporation was organized on a strictly cooperative basis and will make use to the greatest extent possible of all existing farmer-owned grain marketing facilities. If given the support of the existing farmer-owned grain marketing associations, the corporation will handle annually considerably more than 500,000,000 bushels of all grains. General active management of the corporation will be in the hands of a general manager who, the by-laws provide, "shall be a person acceptable to the said Federal Farm Board."

This corporation provides a medium through which the board may make loans to cooperative grain marketing associations, both for current marketing purposes and for the acquirement of physical facilities. The board's policy is to limit facilities loans to cooperatives belonging to central sales agencies.

The plans of the Grain Corporation provide for the extension of cooperative grain marketing activities into the domestic terminal and export markets. This purpose touches one of the vital points of the act and a question which has been widely discussed, that of surpluses that may be stored and withheld from the market. Some critics contend that the failure or success of the act revolves to a large extent around this point and it is one that has created speculation as to what effect the withholding of farm products from the market will have on the consumer. The act, however, says that corporations receiving loans from the board for surplus control operations "shall exert every reasonable effort to avoid losses and to secure profits, but shall not withhold any commodity from the domestic market if the prices have become unduly enhanced, resulting in distress to domestic consumers." No definition is given of "unduly enhanced" prices or of what constitutes "distress to domestic consumers."

Secretary of Agriculture Hyde in his annual report said that by a curious coincidence the agricultural situation, when the Farm Board began its work, was unusually free from difficulties due to surplus production.

"It need scarcely be said, however, that surpluses will recur," he pointed out. "Wise planning may establish a better average balance between production and supply, but cannot wholly obviate the effect of exceptionally favorable weather on production. Seasonal surpluses will be produced inevitably from time to time. The great task of the Federal Farm Board is to assist agriculture in making surpluses less frequent, less burdensome and easier to handle."

The board actually did prove itself a real remedy, little-heralded, in connection with the stock market crash. It felt in October that prices of cotton and wheat were unduly depressed and, to meet the situation, announced its willingness to make loans to cotton and wheat cooperatives supplemental to loans made by commercial or intermediate banks. When the securities market was at its worst, prices at which the board offered to make loans went down momentarily below the loan value in some cases. The board received telegrams from farmers that without its offer of support there

THE stock market crash shifted the spotlight to agriculture. For several years the "poor relation" of industry, the farmer is now an object of new interest.

Was the farmer involved in Wall Street speculation? If not, is his buying power sufficient to help offset losses in the purchasing ability of other classes of the population? What is the Federal Farm Board and what can it do to improve the farmer's economic status?

These questions have been carefully studied by the author of this article, who is staff correspondent of THE IRON AGE at Washington.

would have been a drop of as much as 10 points and that under such a circumstance the cooperatives would have been wiped out, owing to their inability to cover the margin. The fact that the board had offered to make the loan was sufficient to prevent a sharp drop. Knowledge that it was ready to lend the money acted as a stabilizing influence and was a means of saving the organizations and their members from financial disaster.

Farmer's Net Income Has Improved

Stabilization of prices of farm products through Farm Board aid is naturally hoped for as a means of raising the purchasing power of the farmer. In August, 1929, the prices received by farmers for their principal products averaged 143 per cent of the pre-war level, compared with 139 per cent in August, 1928. Secretary Hyde considers it probable that the average level of prices for the 1929-30 season will be fairly close to the August, 1929, average. In the past few years the prices of the commodities bought by farmers have not advanced but have remained at about 156 per cent of the pre-war level so that the exchange value, or the purchasing power, of farm commodities has improved. In the calender year 1928, for example, the prices received by farmers per unit of their principal products would buy about 90 per cent as much as in the pre-war period. This purchasing-power ratio was also 15 per cent higher than in 1921.

"Improvement in the purchasing power of farm commodities, however, is not necessarily synonymous with an improvement in the purchasing power of the farmer," said Secretary Hyde. "Since the farmer's purchasing power depends on the quantity of the commodities he has to sell as well as on their relative unit price, the purchasing-power ratios must not be overestimated as an index of agricultural prosperity. * * * Final proof of agricultural improvement must rest, not on price comparisons alone, but on evidence that the margin between total costs of production and total prices received is increasing. Only when the farmer's net income increases more than the prices of the things he must buy does he obtain an increase in purchasing power. In the last few years a substantial gain of this character has actually taken place. But the crop year 1928-29 saw more improvement in the gross farm income and in the price situation than it saw in the net income of the farmers, because of increased costs, including higher taxes."

It is on the purchasing power of the farmer that hinges the matter of increased buying of power equipment so necessary to place him on a parity with other industries in efficiency of production.

The rapid technical evolution that has taken place in American agriculture, characterized by substitution of mechanical power for human and animal labor, was strikingly shown by Secretary Hyde. He pointed out that the value of machinery on farms, in terms of 1913 dollars, increased tenfold or from $270,000,000 to $2,700,000,000 between 1870 and 1925. In value of machinery for each farm worker, in terms of 1913 dollars, the increase was from $36 in 1870 to $200 in 1925, a gain of 455 per cent. American farm workers using mechanical power now produce from two to five times as much as similar workers in the older countries of Europe. Though all parts of the country have been affected more or less by this technical process, the Western grain-growing areas have been affected most. Mechanical power is rapidly replacing horsepower in heavy work, such as plowing and disking, in all parts of the country, and in the past few years machinery has become important for cultivating row crops and for harvesting.

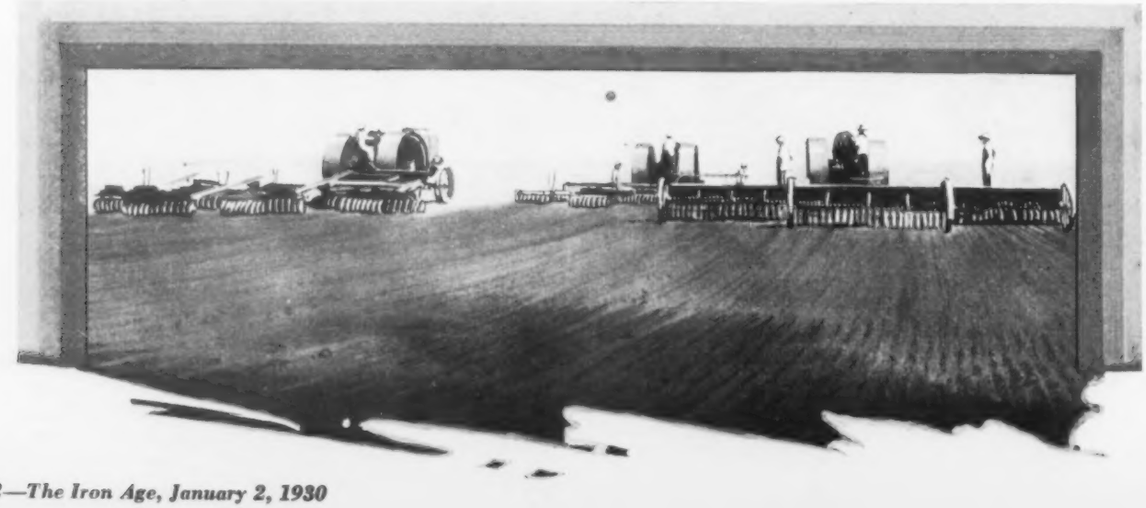
In 1928 the number of tractors produced in the United States was 171,469, reflecting a decline from the output of 194,913 in 1927. Of the 1928 total, 99,820 were sold in the United States, leaving 71,648 for the export market which American producers have built up so extensively. It is estimated that there were about 853,000 tractors on American farms in 1928. Tractors have recently been greatly improved in design and construction. The popular tractor of today represents a middle course in point of size between the large unwieldy machine of early days and the small tractors that followed. In the northern Great Plains region the three-plow and the four-plow tractor are coming rapidly into use, and there is some demand for six-plow tractors.

Total farm equipment production in 1928 at $524,220,514, showed a sharp increase in value over that for 1927, at $460,881,111. Exports for 1929 are estimated at $140,000,000 against $116,000,000 in 1928.

Fewer Mergers in 1929

There were fewer consolidations of agricultural implement manufacturers in 1929 than in the preceding year. The outstanding merger in 1929 was the formation of the Oliver Farm Equipment Co., Chicago, manufacturer of tillage implements. This consolidation has $50,000,000 in capital stock and is an integrated unit in farm equipment manufacture. It was made up of the Oliver Chilled Plow Works, South Bend, Ind.; the Nichols & Shephard Co., Battle Creek, Mich., maker of threshers and combines; the American Seeding Machine Co., Springfield, Ill., producer of seeding machinery; and the Hart-Parr Co., Charles City, Ill., maker of tractors.

The Minneapolis-Moline Power Co., Minneapolis, with about $20,000,000 in capital stock, was organized from the following units: Minneapolis Steel & Machinery Co., Minneapolis, tractors; Minneapolis Threshing Machine Co., Hopkins, Minn., combines and threshers, and the Moline Implement Co., Moline, Ill., tillage implements.





Progress in Manufacturing Methods

Change is unceasing. Progressive steel makers, fabricators, machinists, heat treaters, metal workers generally, have not hesitated to expend large sums to increase output, improve the product, diversify the operations and save labor and human effort.

New equipment and methods replace the old, even when the old is still usable, whenever the change can be justified by economical operation or maintenance, and a lower overall cost.

Ebb and flow of materials, processes and equipment within the metal manufacturing and metal working field are recounted in the reviews and forecasts printed on the following pages. Readers will be helped thereby to appraise the repercussions of such movements upon their own industry, plant, or personal fortunes, and to make the necessary adjustments for continued prosperity.

Open-Hearth Development in 1929

Control of Combustion Conditions, Use of Mixed Gases and Extension of Larger Furnace Are Noted

BY SIDNEY G. KOON



THREE features represent the outstanding lines of development in open-hearth furnace practice during the past year. These are: (1) Increasing use of control devices for fuel and air, looking to a balanced condition in the furnace; (2) increasing interest in the use of mixed gases of controllable heating value; (3) continuation of the movement toward larger and larger furnaces.

Devices to Control Furnace Operation

CONTROL apparatus has taken several forms. It includes not only the proportioning of the fuel and air for combustion in a predetermined ratio, but also the control of reversals of the furnace, either automatically or by signal light, at a definite regenerator temperature or temperature difference, and in some cases control of the stack draft to govern the position of the flame within the furnace laboratory.

In addition to these control devices, which are designed for the triple purpose of conserving fuel, prolonging the furnace life and governing the oxidizing or other characteristics of the flame, some of the equipment which has been put in (insulation and plating) looks to avoiding infiltration of air into the regenerators.

In general, the object is to place the entire furnace operation so far as possible under automatic control, on the basis of scientifically determined ratios or conditions, and thus to remove in large measure the personal elements inherent in previous methods, whereby the first helper was almost the sole judge as to furnace conditions.

Apparatus for the purpose above briefly outlined has been put out on a number of different bases. Installations have been made in several plants by those interested in pushing the apparatus, and in one or two cases a long enough run has been had so that the owners of the equipment know pretty well what it will do for them. Three of the leading developments along this line have been those installed by the Arthur L. Stevens Corporation, Chicago, in a plant in southern Illinois; the Smoot Engineering Corporation, New York, in a plant in eastern Pennsylvania; and the Morgan Construction Co., Worcester, Mass., (Isley furnace control) in a plant in Kentucky.

Continued operation of the furnaces so fitted will give us an increasing volume of data upon which expansion of these systems must depend. Increasing uniformity of temperature within the furnace, with its corollary of slower deterioration in the roof and port ends, has been accompanied by more uniform length of heat and in most cases by an increasing speed of making steel. Reduction in fuel consumption has been reported to an extent which would have appeared startling before we became familiar with what these appliances would do. In one case the management has stated that the savings in fuel and refractories, together with the increased speed of operation, will pay for the equipment in about four months.

Use of Mixed Gases for Melting

BLAST furnace gas and its disposal have long furnished a problem. Customarily the use of the gas has been confined to heating the hot blast stoves connected with the blast furnace and to burning, in the raw state or only partially cleaned, under steam boilers. In a few cases, where more adequate cleaning was available, this gas has been used in gas engines for blowing purposes.

While it has a very low heating value per unit, the immense quantity available at all blast furnace plants makes its total heat value something which management has long wished to conserve.

As it would be impossible to obtain with blast furnace gas alone the required temperature for steel melting and refining, however extensive the regenerator equipment might be, it has been found necessary to mix this gas with another of much higher unit heating value. This mixture has been customarily with coke oven gas, when available. The dilution of the coke oven gas with a certain quantity of blast furnace gas results in a mixed gas with heating value which may be under rather precise control.

Mixing equipment has been installed which will maintain the ratio between the two, and consequently the heat units for a given quantity of the mixed gas, at any predetermined point, regardless of the total quantity of gas being burned at any given time. Both ratio and quantity are susceptible to accurate control at the option of management. Equipment for these purposes has been put in tentatively in more than one plant. Perhaps the most complete layout is that which has been installed for a new

100-ton open-hearth furnace by the Steel Co. of Canada at Hamilton.

Large Furnaces Make Economies

INCREASING sizes of furnaces, in continuation of the movement which has been under way practically uninterruptedly for the past 20 years, has perhaps had its greatest development in the plant of the Weirton Steel Co., Weirton, W. Va. Many other owners, however, have increased furnace sizes either by deepening the bath, raising the fore plates or lengthening the laboratory, when rebuilding furnaces. In this way a number of furnaces have been practically doubled in capacity as compared with their original design, and in all such cases are reported to have made a considerably greater tonnage daily than formerly.

It has been demonstrated, probably beyond the question of doubt, that steel can be made in these large furnaces which will have as good quality as steel made in smaller furnaces. Due to the very bulk of the bath there are some elements related to quality which show an improvement in the immense furnaces with which we are now becoming acquainted.

There is obviously a smaller surface area, to each ton of steel in the bath, in a large and deep furnace than in a smaller and shallower unit. This means that there will be less oxidation of the bath through the slag, which of course, is the point of contact. It may be that at any given moment there is as much oxidation in the large bath for each square foot of slag surface as in the small bath, but the dilution through the much lesser oxidation of the deeper portions of the bath leaves the steel as a whole in much better condition.

Better fuel economy is reported from these large furnaces when compared with their smaller prototypes. Refractory costs are said to be just as good as with the smaller furnaces, if not better. And, with craneways, soaking pits and rolling mills laid out to take the large-size heats, there seems to be no practical operating reason why these large furnaces should not be extended in number. Greater capacity for a given land area and building volume is thereby had, greater tonnage in a day or week results from their operation and in general a more stable condition is reported, owing in some measure to the magnitude of the operation being performed.

Not so much has been heard this year on the subject of tilting furnaces. These are reported by some experienced men as being preferable, in the matter of slag control particularly, to stationary furnaces. They have not been built, however, in the new equipment put in during the year.

Finally, the continued good work of the Open-Hearth Committee of the American Institute of Mining and Metallurgical Engineers, and that of the United States Bureau of Mines, in attacking operating and even design problems through focusing collective, practical, expert opinion on them, cannot be too highly commended. This is not a new development of the year, but it does represent a coordinating of new ideas and a clearing house through which each man's operating problems may be examined, and all those interested be supplied with information regarding means for overcoming troublesome conditions.

Trend in Gray Iron for 1930

Further Development in High-Test Iron—Alloy Iron a Factor—Demand for Wear-Resisting and Impact Properties

BY DR. RICHARD MOLDENKE*

REMARKABLE improvement in cast iron made possible through the discoveries of the last few years from intensive research on this material has found the gray iron foundry industry receptive but also somewhat bewildered. Cast iron, with a tensile strength close to 60,000 lb. per sq. in., seems such a jump to the foundryman that he fears an upset in his production methods to meet expected requirements formerly undreamed of. Hence he waits, while striving to inform himself on how to make this new "high-test" cast iron with the least disarrangement of his production methods and melting schedules. This trend has been very noticeable in the year just passed for, at every gathering of foundrymen, the subject has been uppermost and the discussions emphasized the demand for more light on the practical end of the matter.

As was to be expected, the larger foundries connected with great engineering establishments took up the production of high-test iron castings, first, their object being to reduce the tonnage of steel castings bought. In this they were eminently successful, and the future bids fair to see a recovery by the gray iron foundry of much work that has been lost to the steel casting. However, this will come slowly, and the coming year will witness a gradual improvement in gray iron castings generally, through the attention bestowed upon the melting practice, very high degrees of superheat on the part of the molten iron being aimed at, for this is essential in obtaining the end sought. Incidentally this means the abandonment of bonuses still being paid in some foundries to save coke.

Further, there is a noticeable trend toward specialization in this high-grade material, particularly with nickel additions, for even greater strengths than above mentioned. Certain foundries with progressive ideas are aiming to give special attention to gray iron castings suitable for acid and heat-resisting requirements, and one of the major industries making cast iron products is now looking seriously into stronger metal for reasons competitive.

The coming year will probably see some advance in this direction, together with a cautious though determined effort to get back work lost to steel. This trend will have the support of the Gray Iron Institute and will be carried through more extensively at foundries connected with manufacturing, rather than jobbing establishments, but the effect will be felt more and more as knowledge that strong castings can be readily had will spread.

The year 1930, therefore, looks like one of slow but certain development for the gray iron industry. Meanwhile, much investigation seems ahead, for there is demand for information on the wear-resisting qualities of the various classes of cast iron, as well as how resistance to impact can be safely measured. This will stimulate study on alloy-cast irons, and it is to be hoped that other metals than nickel will enter the field, so that the foundryman may have a wider choice of beneficial additions to his ordinary product, besides finding it less costly.

*Consulting metallurgist, Watchung, N. J.

Developments of the Blast Furnace

Data on the 1000-Ton Stacks; New Stove Base Construction; Use of the Gas

TWO blast furnace developments of major importance are the movement to larger furnaces, having daily capacities of 1000 tons or more, and the very profitable use of blast furnace gas for underfiring coke ovens, for making open-hearth steel, or for use in various types of heating furnaces. These two developments have involved a number of structural changes in the stacks and have made it necessary to give much more consideration to such auxiliaries as stockhouse and blowing equipment, gas cleaners, hot blast stoves and boilers.

For information on these developments dependence may be placed on a contribution made on the subject to the American Society of Mechanical Engineers by Arthur G. McKee, president, Arthur G. McKee & Co., consulting engineers, Cleveland. Accordingly the following observations are those of Mr. McKee with no substantial change:

Furnace Stack

ABILITY to make 1000 tons from a single stack was accomplished rather suddenly, if not dramatically, by a radical increase in diameter of furnace hearth. In the summer of 1927 a furnace was built having a hearth diameter of 24 ft. 6 in., which was about 3 ft. greater than that of any previous design. Previous increases in hearth diameter had been a few inches a year. A few months later this furnace was consistently making 1000 tons daily and for 1928 had the surprising total output of 368,000 tons, or a daily average of 1008 tons. This remarkable achievement by the Jones & Laughlin Steel Corporation was accomplished without adequate adjustment of the other parts of the equipment to the greatly increased demands made by this large output.

It has been long my belief that top development has lagged behind hearth development, and has been the most important cause of seriously increased flue dust losses which have attended the large units and much greater volume of blast they have required. It is an outstanding development of recent months that three furnaces have been blown in having a top diameter of 19 ft., one of which had a hearth diameter of 19 ft., one of 21 ft. 6 in. and the other of 25 ft. The practice of these furnaces has been greatly improved, particularly in flue dust production. Losses in each case have been about 150 lb. of dust per ton of pig iron, whereas from 200 to 400 lb. per ton is common practice with smaller tops.



At present the largest furnace in existence has a 27 ft. 6 in. hearth, but the stock line is only 18 ft. Other furnace dimensions have, of course, come in for renewed study and consideration since the advent of the 25-ft. hearth. Without going into detail, the following figures are suitable for a modern furnace of 1000 tons daily capacity. I believe that these dimensions, or larger, will be recognized as standard in the near future, and it is probable that the stock-line diameter may be increased faster than the hearth diameter, until they are more nearly equal.

Hearth diameter	25 ft.
Bosh diameter	27 ft.
Stock-line diameter	20 ft.
Bell diameter	15 ft.
Total height	95 ft.
Bosh height	10 ft.
Straight section above mantle	10 ft.
Angle of bosh	84 deg. 17 min.
Slope of inwall	¾ in. per foot

A furnace of these dimensions, provided with Lake ores of average iron content and with a good grade of coke, should produce 1000 tons of pig iron a day and the flue dust losses should be very low if the downcomers are properly designed. Little or no scrap should be necessary to accomplish this tonnage. But there should be adequate provision for heating the blast to 1500 deg. Fahr., although the operator may elect to use temperatures somewhat less.

For a furnace of this size the matter of foundations is of utmost importance. The total load on foundations will be some 5000 tons and the foundations themselves will weigh an equal amount. Very careful study of the soil conditions is consequently called for.

Furnace Auxiliaries

NONE of the larger furnaces today are new furnace plants. All are units of old plants wherein the stockhouses, stoves and blowing equipment were originally designed and built for furnaces of 500 tons or less. It is improbable that many additions will be made to the number of furnaces at existing plants, as capacities are more readily and economically increased by enlarging existing stacks.

Stove construction has been brought into prominence recently, both by the requirements of the larger furnaces and by a greater appreciation of the value of blast furnace gas for other purposes. The one has made it imperative to secure greater blast heating capacity and the other has emphasized the importance of gas conservation through higher stove efficiency. And the generally improved furnace

practice has made the use of higher blast temperatures feasible. From 1200 to 1500 deg. is now common practice, which is 200 or 300 deg. higher than the average of a few years ago.

Most of the older furnaces were given four stoves each, which varied greatly in size and type of checkerwork. A common size of the old two-pass stove would be about 21 x 100 ft. Many stoves still in use are of the McClure three-pass type, generally 21 or 22 x 83 ft. or up to 100 ft. Many of these stoves were built more than 20 years ago, before the general adoption of wet cleaning of blast furnace gas, and are still lined with the larger checker openings which dirty gas made necessary. From 35,000 to 50,000 sq. ft. of heating surface was generally the limit for such a stove.

Under such conditions very high stack temperatures were unavoidable—in many cases equal to or greater than that of the blast leaving the stoves. Insulation was generally blast furnace slag, and between high radiation losses and stack losses the thermal efficiency of such stoves was seldom higher than about 60 per cent.

With the advent of gas scrubbers the possibility of using smaller checker openings was quickly realized. Many of the old stove shells have been relined during the past decade with openings of from 3½ to 5 in. and with brick as thin as 2 in. Thus it has been possible practically to double the heating capacities at certain plants merely by relining the stoves with smaller checkers. And use of better insulating materials has reduced radiation losses. Smaller checkers, better insulation and pressure burners were installed in the period from 1914 to 1928, and contemporary with a general increase in furnace capacity from 500 to 750 tons a day.

About 400 to 450 sq. ft. of heating surface for each ton of pig iron produced daily are called for by normal furnace practice. A furnace making from 1000 to 1200 tons a day should have, therefore, 400,000 to 550,000 sq. ft. of heating surface in its stoves, or something more than 100,000 sq. ft. in each of the usual four stoves.

For years we have recognized that smaller checker openings and thinner checker walls were necessary, to get the much greater heating surface required into our present small stove shells. At the same time we have realized that it was impossible to support such small checkers on firebrick arches and girder tiles.

To get the required heating surface in small checkers and to support them safely and permanently, we have developed a new type of checker support, of columns and high-chrome-nickel steel alloy grids, which carry the entire bottom surface of the checker structure, so that it is im-



COLUMNS Underneath the Grids Supporting the Checkerwork Form a Veritable Forest (At Right)



TOP of Grids, Resting on the Columns, and Supporting the Checkerwork of the Stoves (At Left)

possible for the checkers to shift or break down unless from failure of the grids. As these grids are designed for a factor of safety of 15 at a temperature of 1000 deg. Fahr., the possibility of failure of the checkers or their supports is practically eliminated.

Each part of this stove is self-supporting and free to expand vertically, independently of all other units, so that there are no undue strains set up by unequal expansion of the different parts. The checker tiles are so interlocked that they cannot become displaced laterally and at the same time the individual tiles are free to expand vertically.

With blast furnace gas of the cleanliness obtained from washers now in common use, containing less than ¼ grain of solids per cubic foot, it is feasible to use checkers as small as 2¾ in. square or 3 in. round. A 21 x 100-ft. stove lined with 2¾-in. checkers and our metal bottoms, and having 2½-in. insulation of Sil-o-cel, will have 108,000 sq. ft. of heating surface. Four such stoves are probably ample to provide blast heating capacity for the largest furnaces, while maintaining a high degree of thermal efficiency, although such a happy combination of equipment as a 1000-ton furnace and stoves of 432,000 sq. ft. has never been tried. Four 22 x 100-ft. stoves would provide 480,000 sq. ft.

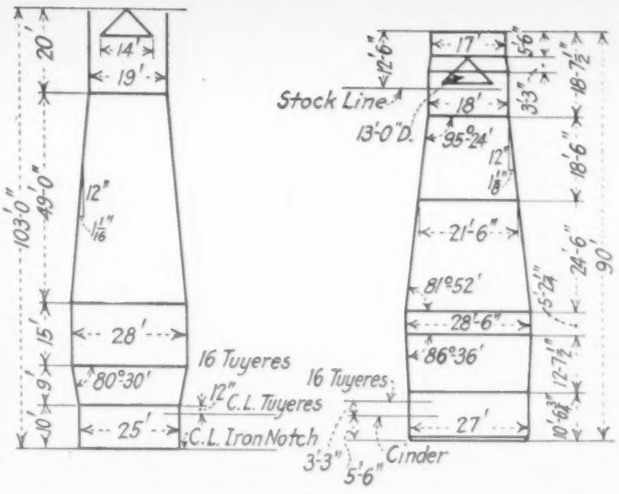
Three stoves of this type have been designed and built for the Steel Co. of Canada, Hamilton, Ontario. It was found unnecessary to reline the fourth stove, the large capacity and high efficiency of the new metal-bottom stoves of 21 x 90 ft. making it possible to get all the blast temperature desired from three stoves remodeled in this fashion, when blowing 47,000 cu. ft. of blast and making nearly 700 tons average output.

Use of Blast Furnace Gas

UNTIL recently in normal American practice the use of blast furnace gas has been limited generally to heating stoves and generation of steam. In a few plants it has been used in gas-engine-driven blowers and electric power generators. During the past year we have witnessed the inauguration in this country of underfiring coke ovens with blast furnace gas.

Two merchant furnace plants having adjacent by-product coke ovens are now using this means to increase their revenues by releasing large additional amounts of coal gas for sale. Both are in the Chicago district, where there is a large and profitable market for this commodity.

Coke produced in ovens heated by blast furnace gas has proved more of uniform quality than when the same ovens were fired with coal gas, and the blast furnace practice is said to have been improved by the change.



Lines of Two Modern 1000-Ton Furnaces, Showing Considerable Variation in Practice

Where the blast furnaces are operated in conjunction with coke ovens and steel plants, another profitable means of utilizing the gas is in open-hearth furnaces, soaking pits and heating furnaces. Mixed with various proportions of coke oven gas, it has proved to be ideal for these purposes.

The first complete American plant of this type, the Steel Co. of Canada, Hamilton, has been in operation for several months. Officials of the company say that the results have been highly satisfactory, both from the standpoint of operation and the economies obtained.

The peculiar advantages of a mixed gas system will be apparent when one considers that probably no two of the various heat processes employed in the manufacture of steel products will call for the same intensity and quantity of heat, and that mill practice must be greatly improved when the B.t.u. value of the fuel employed is accurately adjusted to each particular use. The two fuels, blast furnace gas of about 90 B.t.u. and coke oven gas of about 550 B.t.u., furnish an admirable means of obtaining an ideal fuel by mixing. At the plant in question the heat values in use are as follows:

	B.t.u.
Open-hearth furnaces	250
Merchant mill heating furnaces	325
Soaking pits	90
Sheet and pair furnaces	150
Sheet box annealing furnaces	125
Sheet galvanizing pots	90

Reduces Dust Losses by Enlarging Blast Furnace Stock Lines

ONE of the outstanding improvements of the year in blast furnace practice has been the reduction of flue dust at the Duquesne blast furnaces of the Carnegie Steel Co. Their 16 and 17-ft. stock-lines were changed to 19 ft. The amount of dust has been reduced to 50 to 75 lb. per ton of pig iron over a period of months, whereas furnaces in the same group with small tops have been producing about 250 lb. per ton of iron.

L. E. Riddle, general superintendent of the City blast furnaces and superintendent of the Duquesne blast furnaces, is the pioneer in this work. He held that by increasing the area of the top of the stock-column the dust-carrying power of the gas would be materially reduced by lowering the velocity of the gas passing through the upper portion of the stock-column. Duquesne dust recovered is 75 per cent or more of the total produced and in comparison with the furnaces which still have 17-ft. stock-lines the improvement made has been notable.

The recently changed furnaces have about ¼ in. to the foot batter above the mantle, carried all the way to the top in some cases; in others 9 ft. of straight wall or less.

Duquesne No. 5 furnace now being rebuilt will have a 20-ft. hearth and a 20-ft. stock-line; No. 1 has a 19-ft. hearth and 19-ft. stock-line; No. 2, an old furnace, was recently changed from a 16-ft. top with a 12-ft. bell to an 18-ft. 4-in. top with a 13-ft. bell, the hearth diameter being 18 ft. No. 3 has a 19-ft. hearth and 17-ft. top, while No. 4 has a 20-ft. 6-in. hearth and 19-ft. top.

The tonnage output of these furnaces per sq. ft. of hearth area is understood to be far above the average furnace. Reduction in flue dust was made, with no reduction in volume of air blown. By enlarging the tops the velocity of leaving gas has been reduced by about 40 per cent over what is was with the 16 and 17-ft. tops.

Progress in Pressed Metal

Higher Speeds and Automatic Feeds Feature Development in Machines—Coiled Tin Plate Presages Radical Change in Can Making

BY E. V. CRANE*

ROUNDING out their biggest year in history, the pressed metal industries can catch their breath a bit during this present period of inventory and model change, check up on new developments and take stock of new trends in the trade. Enthusiasms have not been dampened materially by recent curtailment of paper values, for first-quarter budgets indicate a healthy crop of equipment orders even from the so-called luxury trades. Manufacturers are preparing for future business carefully yet energetically and with full confidence in what is to come.

Developments of the year in the pressed metal industries have three aspects—as viewed by the manufacturers of metal stampings, as seen by the mills rolling sheet, strip and coiled metal stock, and as they appear to the builders of press equipment.

The advances in each of the three industries have a direct and far-reaching effect on the trend of the other two. Thus, the standardization of parts and the betterment of marketing methods of manufacturers have increased the quantities of stampings required to such an extent that the general trend is toward higher speeds and automatic feeds for press equipment.

This means to the press builder, a demand for more rugged machines to conserve the life of expensive dies at the high speeds required. It means to him, also, that sturdy, accurate, automatic feeds are needed. It explains to the rolling mill the increasing demand for coil stock for continuous automatic feeding.

Huge quantity production, coupled with the ever-present endeavor to increase production and cut costs, has led to an increasing use of automatic press units, especially for blanking work in the automobile, electrical, radio, business machine and other industries. An outstanding development is the new type of standard automatic press line brought out by the Bliss company and called high production presses. The operation of single, multiple and follow dies in these machines, at rates of 200, 300 and 400 strokes per minute, has placed a new high limit on production speeds. Many combinations have also been made of automatic metal working units with intermediate conveyors, hoppers, etc.

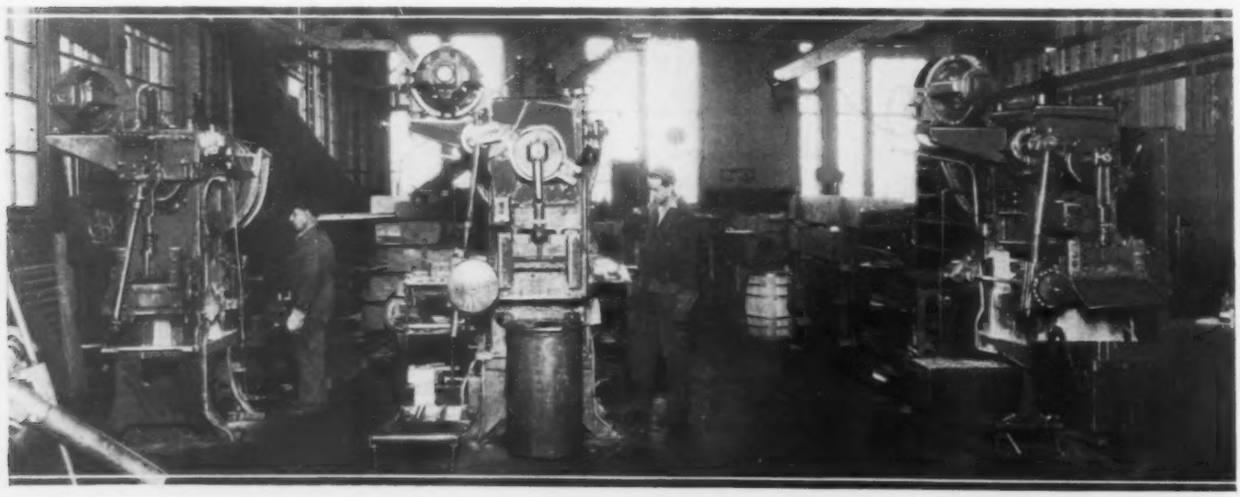
The new types of equipment and the adoption of refinements for greater speed and convenience for the older types necessarily add to the costs of construction. Though it has taken many in the trade a long time to realize this, it is heartening to the press builder to find that the restrictive per-pound basis of judging equipment values is slipping gradually into the discard.

Principle of Continuous Flow of Material Popular

The trend in the automobile industry toward the use of a press for every operation is an interesting extension of the assembly-line idea to the preliminary press work. Many plants are adapting this continuous flow principle and material moves practically without stops from the sheet metal at the receiving end to the finished and assembled product in the shipping department. Along these same lines has been the substitution of one large press for two and sometimes three smaller ones, by setting two or three dies in the large machine and moving the work progressively from die to die by hand.

Then, too, there is present in all industries a continual shift from castings to stampings. First to be replaced, of course, were the smaller, thinner pieces, but

*Staff engineer, E. W. Bliss Co., Brooklyn.



Three Bliss High Production Presses in the General Electric Plant, in Bloomfield, N. J., Operate at as High as 400 Strokes a Minute

now larger and heavier sections have been redesigned and presses are doing more and more work in the heavier gages.

Sheet Mills Are Stamping Blanks

There are several sheet mills that are solving the ever-embarrassing problem of scrap by stamping out the blanks for their customers. This new development recalls the experience of the manufacturers of cartridge cases during the late war, who found it more economical to buy the blanks in kegs. The brass makers punched the slugs out of the sheet at the mills and ran the scrap right back to the furnace. A tremendous saving was made in freight and other handling charges on the large quantities used.

The rolling mills are also alive to the fact that there is a demand for more carefully annealed metal sheets. There have been installed continuous conveyor annealing equipments to heat treat sheets thoroughly one at a time. The complete annealing of sheets in packs takes a long time and the results are likely to be non-uniform.

Tin Plate in Coiled Form

THOUGH there has been no decrease in the demand for sheet and strip stock, there is a rapidly increasing demand for metal in coils and the mills stand ready to supply it in quite heavy gages. A recent development which presages a radical change for the can-making industry is the fact that at least three mills are now ready to supply tin plate in coiled form. The price is still a little higher than that of tin plate in sheets, but this difference is being made up in some cases by scrap economy and savings in handling. It seems safe to predict that eventually the price of the coil stock will be less than that of sheet, and that the drawing qualities will be somewhat better. The use of coil tin plate in the new automatic high-production presses will mean new high speeds and economies in can top and bottom production.

Developments in Press Design

The press builder stands ready to meet the needs of the manufacturer for new equipment. Press designs are simpler and more rugged and there is a trend toward standardization of sizes and types. Alloy steel crankshafts are being introduced. Roller bearings are being used on the backshafts of the larger machines. Clutches, both rolling key and friction types, are being made finer and faster than they ever have before.

An interesting "slow-draw" constant velocity motion of the crankshaft is being used to speed up the drawing of steel shells as well as for broaching and burnishing operations.

The size of automatic roll feeds has been advanced considerably to handle up to 50-in. feed lengths and widths up to 60 in. Feed rolls have been built up to 15 in. in diameter and rates of feeding obtained up to 1000 and 2000 in. a minute. Laboratory methods are being used to give closer control of all materials of construction.

Developments Slow in Heavy Forgings

Acid Open-Hearth Preferred for Locomotives—Five Types of Steel Prevail—Trend Toward High Quality and Wise Use of Alloy Steels

BY LAWFORD H. FRY*

THE heavy forging industry is passing through a period of slow development. Considerable attention is being directed to the advantages of using sound, well-made steel, and improvement in quality thus effected has extended the range of usefulness of plain carbon steel. For the more severe service, various alloy steels are being used. The behavior of such steels in service is being studied to determine more exactly the field for which each of the various types is best adapted.

In heat treatment the tendency is toward simplification. Instead of quenching and tempering, the less drastic practices of annealing, or of normalizing and tempering, are preferred. These conditions are particularly well marked in the manufacture of heavy locomotive forgings, such as driving axles, connecting rods, crank pins and piston rods.



Lawford H. Fry

Well-Made Acid Steel Preferred to Basic

USERS and makers of locomotive forgings are coming more and more to realize that the first step in the production of satisfactory forgings is to secure sound, well-made steel.

The two largest locomotive builders are emphasizing the advantages to be derived from the use of acid steel in preference to basic because of the greater ease with which clean, thoroughly deoxidized steel of high quality can be made by the acid open-hearth process. Electric steel is used for a small tonnage of locomotive forgings. The electric process facilitates the manufacture of high quality steel, but it must not be assumed that the electric furnace possesses some special virtue which inevitably makes electric steel better than steel made in the flame-heated open-hearth. Care and skill are essential prerequisites in the production of good steel, no matter what process is used.

Five Types for Heavy Locomotive Forgings

FIVE different types of steel take care of practically all of the heavy locomotive forgings being made today. These five steels, which have the composition shown in Table I, are plain carbon steel, carbon-vanadium, low-carbon manganese-nickel, chrome-vanadium and chrome-nickel steel. They are heat treated to give approximately the tensile properties shown in Table II. The three quenched and tempered steels—carbon, chrome-nickel and chrome-vanadium—represent a considerably smaller tonnage of locomotive forgings than is made up in the normalized and tempered condition from carbon

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Table I.—Representative Chemical Composition of Various Steels Used for Locomotive Forgings

Types of Steel	Plain Carbon, Per Cent	Carbon Nickel, Per Cent	Carbon Vanadium, Per Cent	Chrome Vanadium, Per Cent	Chrome Nickel, Per Cent
Carbon	0.48	0.25	0.48	0.38	0.35
Manganese ...	0.60	0.90	0.88	0.60	0.60
Silicon	0.20	0.20	0.20	0.20	0.20
Nickel	...	2.75	...	...	1.25
Vanadium	...	...	0.18	0.18	...
Chromium	...	...	...	1.00	0.80

Note: The figures given represent average compositions such as will be used in working to the specifications current for the different grades of steel. The maximum and minimum content of the various elements will vary from the average figures given by approximately the following amounts: Carbon 7 points, manganese 10 points, silicon 5 points, nickel 20 points, vanadium 2 points and chromium 15 points. For tensile properties see Table II.

steel, carbon-vanadium and carbon-manganese-nickel steel.

As locomotive sizes have increased and as consequently the demands made on forgings have increased, progress has been from plain carbon steel annealed to quenched and tempered carbon steel, then to the quenched and tempered alloy steels, followed by a strong swing at the present time to the normalized and tempered steels.

Quenched and Tempered Alloy Steels Offer Greatest Strength

From the tensile properties shown in Table II it will be seen that the quenched and tempered alloy steels offer the greatest strength. Nevertheless, the care required in making and maintaining forgings from these steels has led to a strong sentiment in favor of steels which can be used without quenching. Refinements in practice and demands of service have caused the old simple annealing to be almost entirely abandoned in favor of normalizing and tempering. By normalizing is understood heating to above the critical range and cooling in the air. This is usually followed by tempering consisting of heating to below the critical range with slow cooling.

Specifications, Formerly Unattainable, Now Being Met

THE change from annealing to normalizing and tempering, together with closer attention to the quality of the steel, has enabled manufacturers to accept specifications for forgings which would have been out of the question a few years ago. This has been recognized by both the American Society for Testing Materials, and the American Railway Association, mechanical division, who have this year issued specifications for forgings with tensile properties which have values about 20 per cent higher than those of the specifications they replace.

Table II.—Representative Tensile Properties for Various Steels Used for Locomotive Forgings

Normalized and Tempered Steels:

Type of Steel	Yield Point, Lb. per Sq. In.	Tensile Strength, Lb. per Sq. In.	Elongation, in 2 In., Per Cent	Reduction of Area, Per Cent
Carbon steel:				
(a) High tensile..	47,000	87,000	24	40
(b) Low tensile...	44,000	82,000	27	46
Carbon-vanadium ...	62,000	98,000	25	45
Carbon-nickel	59,000	84,000	29	62

Quenched and Tempered Steels:

	Elastic Limit, Lb. per Sq. In.	Tensile Strength, Lb. per Sq. In.	Elongation, in 2 In., Per Cent	Reduction of Area, Per Cent
Carbon steel.....	56,000	96,000	23	45
Chrome-vanadium ..	70,000	108,000	22	56
Chrome-nickel	70,000	108,000	22	56

Note: The values given are average values which would be obtained in working to specifications now current for the various types of steel. Maximum and minimum values would vary from the values given by about 5 per cent of these values. For chemical composition of the steels see Table I.

Requirements of the two specifications as to tensile properties are very similar, though those of the A. R. A. are not so well balanced as the values specified by the A. S. T. M. The question of desirable tensile properties for forgings has been the subject of considerable discussion and a number of users have recently issued individual specifications, which show somewhat diverse tendencies. On the one side is a preference for a high-tensile strength with, in consequence, a moderate degree of ductility, and on the other side is a predilection for the highest possible ductility even at the sacrifice of some tensile strength.

Average values of the tensile properties obtained with plain carbon steel, normalized and tempered, are shown in Table II. Values obtained under a high-tensile specification are given at (a) and values obtained under a high-ductility specification are given at (b). The two alloy steels commonly used in the normalized and tempered condition offer the same opposition of qualities. The carbon-vanadium steel gives high-tensile strength with moderate ductility while the low-carbon manganese-nickel steel gives extremely high ductility with a tensile strength about the same as the lower range of the plain carbon steel.

The complete philosophy of the use of these various steels is still to be developed. In general, locomotive connecting rods can be made advantageously of a high-tensile steel, while the high-ductility steel will probably have its greatest usefulness for driving axles.

Quenched and tempered steels are losing ground in locomotive work. Quenched carbon steel is under strong competition from the normalized alloy steels, while the quenched and tempered alloy steels are used only where unusual strength is required along with restricted dimensions.

Industrial Forgings More Diverse

FORGINGS used in the industrial field are much more diverse in character than locomotive forgings. Among the most important large industrial forgings may be mentioned large rolls, spindles for turbines and other machinery, drums for cracking stills, and for high-pressure boilers, and as an interesting special example hollow forged pipe for a high-pressure hydraulic penstock. Bolts or columns for hydraulic presses also account for a certain tonnage. The majority of the forgings enumerated are made of plain carbon steel. In the case of those forged hollow and subject to high internal pressure, such as boiler and cracking still drums and penstock pipe, preference is given to acid steel in accordance with experience gained in the manufacture of ordnance. Normalizing or annealing usually provides adequate heat treatment.

For special rolls where great hardness is required quenched and tempered alloy steel is used. One composition giving satisfactory results is a chrome-nickel-molybdenum steel. The bolts or columns for hydraulic presses are usually not highly stressed owing to the necessity for providing relatively large diameters so as to secure sufficient stiffness.

It will be seen that industrial forgings do not, like the locomotive forgings, offer any homogenous well-defined group of similar forgings, and it is therefore difficult to establish and discuss definite trends as was done for the locomotive forgings. At best one can only note a tendency toward the use of high-quality steel and an intelligent use of alloys.

Steel Castings Will Meet Demands

Progress Aided by Cooperation—Two Types of Alloy Steel—Quality More Important Than Tonnage —Research Must Be Recognized

BY R. A. BULL*

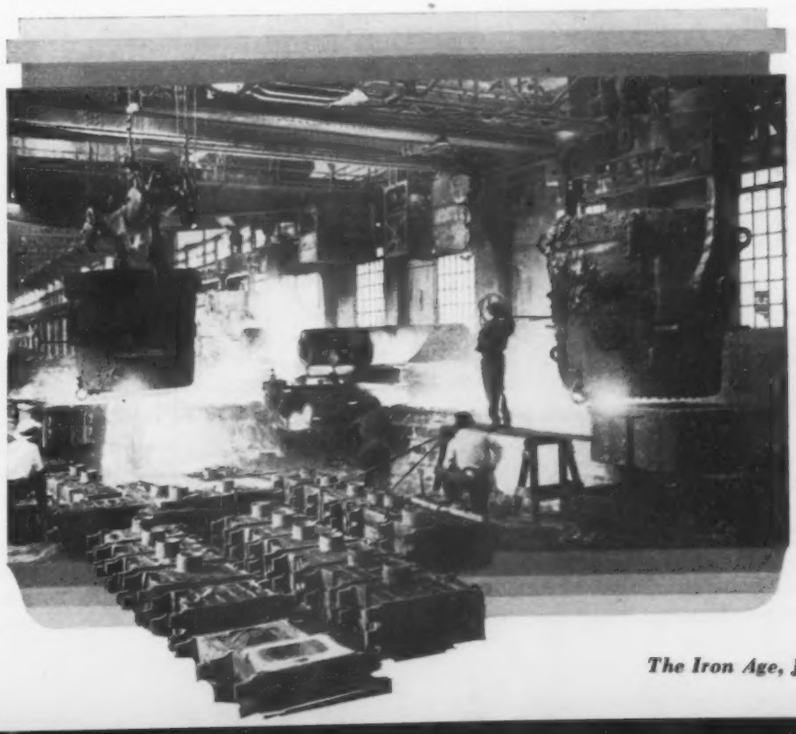
A RÉSUMÉ of the steel casting industry becomes more interesting with every year because of the increasing list of important developments. Nineteen twenty-nine has witnessed a number of significant steps forward that may be mentioned in the summary of industrial achievements.

Progress Stimulated by Cooperation

SINCE it is generally recognized that personnel is the most important factor in any industrial enterprise, we may appropriately comment first on the demonstrated fact that there was manifested during 1929 more of the spirit of cooperation between competitive producers of steel castings and between steel foundrymen and scientists whose work affects foundry principles, than ever before prevailed. There is every indication that the disposition to pool ideas and exchange experiences will increase, because of the commercial benefit that comes, obviously, to producers who cooperate.

This mutually helpful spirit has been signalized by more effective work in the steel section of the American Foundrymen's Association; by accelerated, promising activity in the Steel Founders' Society of America; by the activities of the United States Bureau of Standards and several universities in taking part in metallurgical researches dealing with degasification and other factors, vital in steel founding; by work that relates to steel castings, done by the American Society for Testing Materials, the American Society for Steel Treating, and other scientific and engineering associations; and, in more narrowly confined limits, by the work done in small groups of steel foundries which are prosecuting cooperative investigations, not only of particular benefit to the affiliated companies, but of considerable value to the entire steel casting industry.

That industry now takes pardonable pride in its existence in America for 63 years. It now includes approximately 350 separate plants, which had a combined output of 1,365,000 net tons of steel castings during 1928.



*Director, Electric Steel Founders' Research Group, Chicago.

Output per Employee

Roughly speaking, it may be said that in most cases the monthly output of a steel foundry, in net tons, can be fairly estimated at twice the average number of employees. That is to say, a plant daily employing 500 men will generally produce about 1000 tons per month. The labor cost alone involved in the 17,000,000 or more men-days, now annually required for manufacturing steel castings, is appreciably greater than half of the total cost. We mention these figures to emphasize the fact that the task of running a steel foundry is one that makes maximum demands on technical skill and managerial genius; and, incidentally, on merchandising ability.

It is not surprising under these circumstances that there prevails today among the many progressive steel casting plants in the United States not a comfortable reliance on local personnel to best solve the problems of today and of the future, but rather a definite, growing realization that desirably rapid progress can be made only by exchanging information with many intelligent colleagues.

Alloy Steels—Simple and Complex

TURNING to the recognizable technical advances made in 1929, our attention is drawn first, as a matter of course, to the developments of alloy steels for casting purposes. Such steels may be grouped into two classes, which we may call simple and complex. The former embraces those steels for castings which may be termed special, not because of the introduction of unusual elements in chemical composition, but on account of the unusual percentages of the elements always found in steel, albeit not so extaordinary as radically to transform structure and to affect behavior.

Castings of special steels in the simpler category have been produced during the last few

years, and particularly during 1929, in rapidly increasing quantities, due to the very satisfactory experiences of consumers with the products, thus creating greater demand, and providing the needed stimulus for manufacture.

Wider Use of Medium Manganese Steel

The most widely known of these steels is characterized by a relatively high manganese content, usually running between 1.10 per cent and 1.70 per cent. The growing consumption of metal of this kind (which is now sadly in need of a descriptive name to distinguish it from manganese steel of the austenitic variety and from steel intended to contain ordinarily less than 0.80 per cent manganese) has caused casting makers to apply discriminatingly selected, carefully controlled heat treatments for the individual jobs. It is not a newly discovered fact that when we get out of the range of the common, or garden variety, of steel generally used for castings, we are handling a product that is peculiarly, and fortunately, susceptible, through the application of heat, to structural changes having decided influence on physical properties.

The Higher Alloy Steels

Paralleling the development in the manufacture of the simpler alloy steels, there was much progress made in 1929, in the production of steels for castings to satisfactorily withstand the destructive influences of corrosion, abrasion and intense heat. Naturally in such fields, foundrymen have learned much from producers of rolled and forged steel products, with whom they have been exchanging data in the joint effort to determine what combinations of the elements adapt themselves most satisfactorily to the special services mentioned.

This has been no easy task, largely because of the great difficulty in making comparable tests in the laboratory. The determination of the properties of the metals from service tests requires much time in many cases. But this is not deterring progressive steel casting manufacturers from making experimental alloy heats for trial applications where reliable service data are not available.

New Molding Sand Problems

MENTION of progress of the steel foundry industry during any year of the present decade would be incomplete without reference to the subject of molding sand. There continues to be a wide application of the information that has grown out of the work of the Joint Committee on Molding Sand Research, supported so admirably by many organizations and institutions and organized by the American Foundrymen's Association.

An important feature of this improved knowledge of molding sands has been definitely related to conservation. Reclamation equipment has been installed in numerous foundries for the conditioning of used sands. Some plants have reached the conclusion that they could not economically use old sand to the great extent they at first thought without treatment that would be too expensive to consider. There are today differences of opinion and many deferred judgments as to the extent to which used molding sand can be most economically employed for the manufacture of the highest grades of steel castings.

The attitude, generally, today is not one of denial that old sand can be used effectively, but of question as to the extent of advisable use, and the nature and expense of conditioning. Naturally, this matter of cost is associated with the price, a factor that varies tremendously with the foundry's distance from sand deposits.

Tonnage—A Factor of Diminishing Significance

AS to output, the industry as a whole has had a satisfactory year. The total tonnage cannot be determined at this time, but it seems reasonable to believe there was a greater quantity of steel castings, by not less than 25 per cent, produced during 1929 than during the previous year, when output, according to all the data available, amounted to approximately 60 per cent of capacity, and when the tonnage of alloy steel castings represented roughly 14 per cent of the tonnage of all steel castings made in the United States.

Reference to a relatively low percentage of output as compared to capacity naturally leads to discussion of an economic factor that was faced by this industry, and by many others, more intelligently in the year just closed than in former years. It is a factor that will be brought home more effectively to everyone concerned in the future than it is today. By this, we mean a proper appreciation of the price one should ask for what he makes.

And that price, quite obviously in the steel casting industry, should be based on the degree of success that can be reasonably expected when output amounts to no more than two-thirds of capacity for the average plant. There has been much dissemination of sound advice on the subject of selling any commodity at a price neither lower nor higher than is justified by its cost, when production is at a fair rather than a high rate.

Price Must Recognize Research

In any metal industry that has not quite obviously attained its complete technical development, the justifiable price to the consumer must include suitable provision not only for the production cost itself, but for such investigational and development work as may make the product capable of meeting future demands now beyond the ability of the material to satisfactorily withstand.

Maintenance costs of steel castings and of other metal products are sure to be considered much more thoughtfully by consumers in the future than they have been in the past. Nineteen thirty will witness one of many annual steps forward in this particular connection, as last year showed an advance beyond the conditions existing in 1928. Thus inevitably for an increasing number of purposes, material that is now regarded as satisfactory will be classified as obsolete ten years hence.

This is bound to have its strong influence on tonnage produced in the steel foundry and elsewhere, so that the factor to be stressed in many quarters will be quality rather than quantity. The policy of conservation and the cost of maintenance will be forced to, and kept at, the front of the industrial procession.

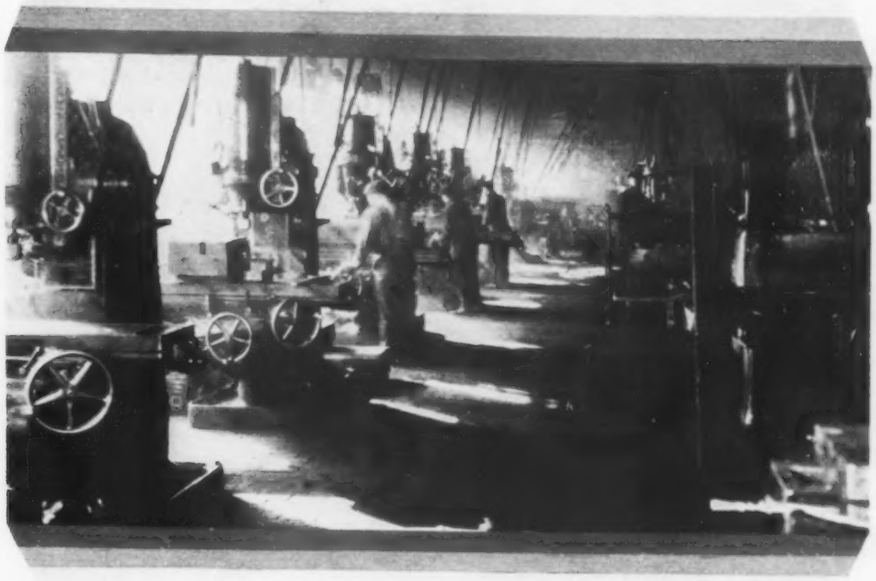
All of this will provide for the steel casting industry an invaluable stimulus. It must be accompanied by a willingness to pay commensurately for improved serviceability. Lacking either of these requisites, the steel casting industry, like every other one, would make insignificant progress. Industrialists are essentially businessmen, not pure scientists, much as they rely with honest appreciation on the truths ascertained in the quiet atmosphere of the laboratory. The technical development of an industry must be made to pay in dollars and cents.

In these respects it is pleasing to observe that the day has arrived when, because of purely economic conditions that must be confronted, many who use steel castings are giving proper consideration to the endurance and serviceability of equipment. This, incidentally, constitutes the primary incentive for alloy steel casting manufacture.

In Better Condition Than Ever

The writer is prompted now to state his opinion that the industry with which he has been connected for 30 years is in a more satisfactory condition to make technical and commercial progress than it has ever been before. And without claiming to be prophetic by temperament, he feels safe in predicting that the steel foundry will be found competent to meet the demands of all industries served by it, however exacting future requirements.

Machine Tools Face a Good Year



They Produce More Work of Increased Precision with Less Fatigue—Research Fostered by Profits Gives Large Returns to Buyers

BY F. A. SCOTT*

THE short and simple story of the machine tool industry for 1929 will be: The largest earnings since the War, and, in all likelihood, the largest dollar volume of sales in its history. The latter, if it materializes, will be due in part to a higher price level. The year produced the usual crop of rumors of mergers and combinations, but nothing impressive was announced.

The industry entered 1929 with an excellent volume of orders; the demand increased as the year proceeded, and no decrease in volume was generally noticeable until the beginning of the fourth quarter. There was a very evident lessening of pressure for tools weeks before the severe stock market losses occurred. It may be that this reduction in demand has been somewhat accentuated by the stock market panic, but the sales volume as the year closes is still good.

Since the stock market panic, requests for cancellations and deferred deliveries have been encouragingly moderate in number, which is contrary to the experience of machine tool producers at the outset of previous depressions. This certainly reflects an undiscouraged attitude on the part of American metal industries, for machine tool sales are spread broadcast over all of them and would react, to any timidity on their part, quickly and violently.

The demand for machine tools in 1929 was so great and so general that it would scarcely be possible to designate particular areas or industries as points of origin. Prominent in the list of large buyers of machine tools during 1929 were the electrical industry, the automotive industry, and the oil industry. Aeroplane factories, also, are taking their place among the larger sources of demand.

The Machine Tool Exposition held in Cleveland, in September, had an attendance of approximately 25,000, which was twice as large as that of two years ago. This is believed to be the largest attendance at any machine tool exposition ever held on this side of the Atlantic, and the show in exhibit space, number of exhibits, and attendance, this year rivalled the great International Exhibit at Leipzig which has been recognized as the world leader. The visitors were assembled from every machine-tool-using country on the globe, and represented the great machine tool users of our own and foreign countries, as well as our machine tool manufacturers.

More Output with Less Effort

THE emphasis of the new designs exhibited was more production per man hour and less effort on the part of the operator. It is evident that American manufacturers are continuing to move on the line which has become the marked characteristic of our metal-working methods—more work in a given time with less fatigue. Accuracy of product has also been emphasized, so that each year marks an advance in the closeness of limits which can be attained by machine operations, while at the

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same time the number of operations is reduced and production increased.

The stimulation of the War and the vast field afforded by America's world-leading metal plants, the acceptance and employment of research preceding and following new design, and the cooperation generously extended by many large American users, have enabled our machine tool manufacturers to maintain, through another year, our position as world leaders in this field. The group of impressively efficient mechanisms exhibited at the exposition gave conclusive evidence that research, in the fullest sense, is responsible for our industry's product.

Fruits of Research Go Promptly to User

THE development of new possibilities involving cutting materials, hydraulic feed mechanisms, automatic controls, and many other elements, gives a limitless field for investigation and experimentation, the advantages from which will be passed on to the customer. To illustrate: the use of cemented tungsten-carbide cutting tools is fast coming into prominence. This is making new demands on the machines, and opening up new possibilities to the designer. Progressive machine tool manufacturers are studying and experimenting to determine just what can be accomplished with this new material. It may be that results in design will prove as revolutionary as those created by the introduction of high-speed steel.

The shoemaker's children go barefoot, and so the machine tool industry has always spent its energies rather more generously in improving the equipment and processes in the plants of its customers than in its own. For several years, however, there has been a marked change in this tendency, and 1929 was especially notable for advances made by American machine tool plants in production methods involving new equipment.

The absence of foot gear for the children was related more to the shoemaker's slim purse than to neglect of his offspring, and it may be assumed that the wide advance of the machine tool industry in research and in modernizing its own equipment this year reflects the better earnings and more comfortable financial situation following several good years.

To the American metal trade, this change is a benefit widely distributed, for the customer will be the ultimate beneficiary. This brings forward again the oft-repeated assurance from machine tool makers to their trade that a more liberal attitude on the subject of prices will inevitably return benefits to the users in the form of tools of higher productivity. Research has become as essential in this field as in others, and research in industry waits on earnings.

Changing Conditions in an Impressive Export Business

FOREIGN trade during 1929 was impressive in volume and extent of territory covered. No machine-tool-using country on the globe is absent from the list of this year's customers of the American machine tool manufacturer. But, in many lines, this trade has been secured in the face of serious discouragements. The lower wages and longer hours of the English and German machine tool factories are reflected in lower prices on their products, and the pressure of this competition on the standard types of American tools is increasing. In the more complicated types of high productive tools, America leads.

Those countries in which metal-working is of modest volume are users of standard machines, and are, therefore, the battlefields of the American, English, and German producers. This is especially interesting in view of the large trade enjoyed by American manufacturers of machine tools, generally speaking, in both countries mentioned. England is steadily modernizing her engineering plants, and it now appears beyond question that this trend will re-establish many of her industries which have been lagging. The campaign in England of "buy British-made goods" was continued through the year, and although it has had some effect on the volume of American machine tool trade, its final influence, in so far as it excludes better equipment than is now available from English factories, will be harmful to British production.

If, in the spiritual realm, we must "know the truth" to be free, we can with equal confidence believe that cold-bloodedly acquiring the most productive equipment will better enable us to meet competition than following a slogan, be it ever so patriotic. We can understand and sympathize with the need for England to re-establish through home patronage her industries, crippled by the War; however, it is an economic policy that involves serious risks.

Used Tools Small Factor in 1929

The appearance of used tools in the market in competition with new machines seems to have been a smaller factor than in any year since the War. This fact, if it prove to be the fact, is probably due to the employment in most plants of their entire equipment on goods urgently needed. In such a year, neither the user nor the maker of machine tools gives as much time to the subject of readjustment and displacement as to new and additional equipment. A quiet year will probably reverse this condition.

Peering into 1930 discloses a less well defined prospect than could be seen at the opening of 1929. A year ago the evidence was all in favor of a twelvemonth of unprecedented prosperity. This year many evidences of good business may still be observed, but there are some disquieting elements.

Trend Toward a Good Year

HOWEVER, the trend is now toward a good year. The demands from the farming communities, railroads, building industry, and general trades will be good. This will be helpfully reflected to the machine tool industry through many channels.

There is a general movement, also, toward the stabilization of many industries, due to the steady advance toward a higher standard of living and an increased sense of proportional values within the great body of our people. The meaning to the family of the possession of an automobile, a radio, electrical labor-saving machinery, etc., as reflected in a broader and happier existence, is sinking into our people and, projected through a few years, will alter our civilization and improve it. This is not a theoretical but a practical advance and practical, indeed, in its reactions on American manufacturing and merchandizing. As the machine tool in a machine age has been one of the most important factors in this change, so also will it continue to be a beneficiary.

This and a number of other factors are constantly contributing to the stabilization of the machine tool industry. The ever-widening area of its own foreign sales territories, the steady increase in foreign demand for other American metal products, and the widespread movement among American metal-working concerns to stabilize their production programs by diversifying products, must all contribute. There has been an impressive movement in the metal field toward acquisition or development of kindred lines or products requiring plant facilities similar to those possessed, to assure balanced or year around production.

The industrial conferences sponsored by President Hoover have already had an influence and bestowed benefits which will continue to be helpful as we proceed into the new year. Business men may justly be skeptical over the prospect of creating business by gathering into groups to tell one another to go ahead. Sending the boy out to lift himself over the fence by his boot-straps re-

sults in nothing save damage to the boot-straps and the boy's credulity. But the act of going ahead, or proceeding *now* with projects already planned to meet a recognized need, and, therefore, economically sound, is of value in the practical sense and even more helpful psychologically. This much the conferences have already accomplished.

Minus the stimulation of the President's conferences, the country might not now be possessed of the valuable knowledge of a great volume of sound business immediately assured. The announcements that the railroads, the steel industry, street railways, telephone and electrical systems, and State and municipal governments, to mention only a few, will proceed with vast programs of expansion and improvement assure a liberal and widely diversified demand for American products. Such a call for American materials inevitably involves a continuing and a large market for machine tools.

Sheet Rolling Undergoing Evolution

ONE of the outstanding developments of the past year in the steel industry has been the widespread licensing of sheet steel producers to use the continuous sheet rolling mill process, covering which the American Rolling Mill Co., Middletown, Ohio, has developed and controls a very broad and comprehensive patent structure.

The United States Steel Corporation, the Republic Iron & Steel Co., the Youngstown Sheet & Tube Co., the Otis Steel Co. and the Gulf States Steel Co. have signed such licensing agreements. Other companies which had previously been licensed are the Wheeling Steel Corporation and the Weirton Steel Co., the latter now a part of the newly organized National Steel Corporation.

These companies, together with the American Rolling Mill Co., control about 75 per cent of the present sheet-making capacity of the United States, a situation which suggests the possibility that eventually most of the sheets produced in this country will at some stage of their manufacture be rolled on continuous mills.

Only Few Licensees Using Process Now

NOT all of the companies which have been licensed have as yet started the use of continuous mills. The Gulf States Steel Co., for example, has an expansion program under way, which includes mills for the rolling of sheets, but equipment for continuous rolling has not been installed, and it may be some time before such a development occurs in that plant. The Republic Iron & Steel Co. now has a continuous mill in operation. The Wheeling and Weirton companies have been using the process for some time. The United States Steel Corporation is working on an adaptation of the continuous mill process for the manufacture of black plate for tinning. This is being done at the Gary works of the American Sheet & Tin Plate Co. Contracts have been signed only recently with the Youngstown Sheet & Tube Co. and the Otis Steel Co., so it may be some time before they become definite factors in the production of sheets by the continuous process.

If all existing sheet producing companies were licensed to use the American Rolling Mill Company's process, it is obvious that the total sheet capacity of the country might well exceed a reasonable growth in sheet demand for years to come.

An output as high as 1500 tons in an 8-hr. day, or more than three tons a minute, which has been accomplished by some mills, shows that this method of manufacture can only be economically used where volume production is demanded.

There have been and will be various adaptations of this process. One company is using the continuous process to a large extent in making skelp for its pipe department. The Republic Iron & Steel Co. will use it chiefly to supply steel for its new electric welded pipe department. Others are using the mills for the breaking down of material, the finishing operations to be performed on either sheet or strip mills.

Most of Product Undergoes Further Finishing

ALTHOUGH sheets made by the continuous process and without further finishing are being sold for some purposes, a good deal of the tonnage turned out by these mills is being finished on the so-called conventional mills or, as stated above, is being used for some specific purpose such as the making of skelp.

It is obvious that every existing manufacturer of sheets, large and small, could not economically adapt this quantity production method to its particular needs, and it is probable that those who control these patented methods will not issue any more licenses than are required to meet the real economic need of the industry.

This evolutionary method of producing this basic product should result in substantially lower costs where large tonnages are required. It should place the manufacturer of sheets in a better position to serve efficiently the large and growing sheet consuming industry, and at a fair profit to the industry itself, which has an enormous investment to deal with, including a slow capital turnover.

The basic, economic need for sheet metal in the many grades demanded has revealed an ever increasing demand which will be accelerated and helped by this new and economic method of production.



For driving a 22-in. Continuous Bar Mill, the Westinghouse Electric & Mfg. Co. Built a Synchronous Motor of 5000-hp. Rating, and of 25-ft. Diameter

Progress in Materials Handling

Mechanical Engineers Find That Chief Advance Has Been with Electric Trucks of Great Flexibility

WHILE there is no yardstick by which progress in materials handling can be measured, greater advance along the line of utilization of industrial trucks is reported than in any other field of materials handling. This subject came up for extended discussion at a New York meeting of the American Society of Mechanical Engineers. What follows is largely abstracted from the report of the Materials Handling Division of that organization.

Manufacturers of materials-handling equipment report that they are now frequently called into consultation when plans for changes or additions are in very early stages, so that the scheme or plan under consideration may be developed with particular reference to proper materials handling. They say also that the increased output per unit of machinery has been a big factor in making proper handling methods a necessity.

Another important development seems to be that the average manufacturer now has generally got away from the thought that his product could not be handled on chains or conveyors because it was "entirely different."

New Ideas in Electric Trucks

This year a truck has been brought out with battery mounted above the deck directly over the front wheels. In this position it acts as a counterweight for the overhung loads for which this machine was designed, i.e., cranes with extensible topping-lift booms, and for the vertical elevating mechanism on which can be mounted shovels, crane arms, rams, stacking tables and devices for stacking cylindrical and rectangular packages. The mounting of these various devices is so made as to permit changing from one to another in a couple of minutes.

This machine has the same wheel units, power units, steering mechanism and control as on the older line, and these are therefore interchangeable between the two types of truck. The new trucks are made in three sizes, having 36-, 48-, and 60-in. wheelbase lengths.

When equipped with a telescopic topping-lift boom, two power units are mounted over the battery, one for raising the boom and the other for hoisting the hook. Trucks so equipped will carry 3600-, 4800-, and 6000-lb. loads at high speed over ordinary street pavements or on cinder-filled yard areas. To change from the shovel to the ram or any of the other tools used with this machine, it is necessary only to cast the rope off the equalizing bar and pull out the hinge pin at the bottom of the crosshead.

A similar elevating mechanism has been brought out in the form of an attachment to the jack-lift truck which has been made for years. This attachment automatically locks to the frame of the truck, and then the jacks raise the attachment to the operating position in the same way as the crane attachment which has been used with this truck for years.

Hand Truck of Improved Type

A new hand truck has been developed known as the foot-lift truck. This enables the operator to elevate the load by using the full weight of his body, rather than calling into play his back and stomach muscles, which are used when the load is elevated with the steering handle. The foot pedal is so designed that it automatically engages with the load-elevating means when depressed, and automatically disengages when it is returned to normal operating position.

The room required to operate this truck is much less than with any other type, as it is necessary only to provide sufficient space for the operator to stand in front of the truck, whereas on the handle type it is necessary to have aisle room to bring the handle practically to the floor in raising the load.

Conveyors Used in Plating Rooms

A rapid and extensive use of conveyor-type systems for electroplating and deposition of metals has been reported. Estimates made by manufacturers of this equipment indicate in many cases that the labor is cut 20 to 25 per cent, and at the same time the material is transported from one point in the plant to another for the next operation. When such a system takes the place of the old still-tank plating, the floor space is only a fraction of what was previously required and there is almost complete elimination of the sloppy condition usually prevailing in plating rooms.

Another significant development in the metal-working field is the handling method adopted by the manufacturers of tinplate and sheet steel, who are loading this material into freight cars on standard skids by means of storage-battery industrial trucks so that the recipient can unload them from the same skids with the same type of truck and effect a great saving in the handling cost.

Several Automotive Handling Jobs

A manufacturer of automobiles has adapted the fork-type truck to select bodies of the correct color to fit the specification of the chassis on the assembly line. Previously bodies have been taken from the conveyor horizontally, mechanically tilted on the cowl end, then revolved, picked up by a truck, and finally stood on end. The new method has reduced storage 66 per cent and has saved an investment of $250,000 which had been appropriated for new storage warehouse.

Among the first attempts to put forge-shop production on a continuous basis is the materials-handling installation made at a motor-car plant in Detroit in a new forge shop for crankshafts. This development has been made possible largely through the medium of materials-handling equipment. The crankshaft forge shop is laid out for straight-line, continuous production, with no stock of parts at any operation.

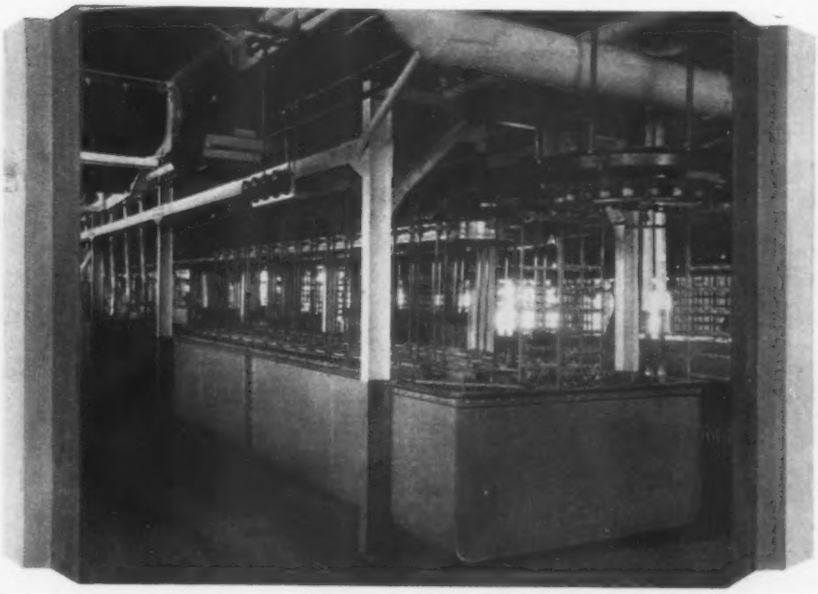
Travel of the metal from the original bar stock through all processes, and finally into the railroad car for shipment, is handled by various conveyor systems. There are five forging units, three heat-treating furnaces, and two pickling machines. This equipment handles 7500 crankshafts a day.

Bar stock is converted into crankshafts, delivered at the shipping platform, in only 4½ hr. In all, 225 men are employed here.

Much Progress Made in Electroplating

Introduction of Automatic Equipment Has Lowered Plating Costs and Speeded Up Production

THE growing interest in electroplating shown by plant engineers, metallurgists, chemists and production executives generally not only resulted in considerable progress being made in that field in the past year but also augurs well for the future development of new methods which will increase quality and lower costs of plating metal products.



Until recently these plant officials have largely neglected plating problems. However, the manufacture of automatic plating equipment, the popularity of chromium as a protective agency and the general agreement that proper coatings against rust resistance are of vital importance have drawn their attention. Since these men have much to say in regard to manufacturing processes, it is not surprising that modernization of plating methods has gained impetus.

Prior to 1925 not more than 50 large metal-working establishments in this country were equipped to do plating automatically. Today there are over 200 plants so equipped and the type of work turned out runs the full gamut of electro-deposited coatings, including nickel, copper, brass, gold, silver, zinc, tin, cadmium and chromium. It is interesting to note that two safety razor manufacturers are gold plating their products automatically while an outstanding maker of silverware is silver plating flatware automatically with the weight of the silver deposit predetermined.

Plating Department No Longer Is Bottle Neck

Plating departments have long been the bottle neck in the production line simply because every operation was done manually. With the coming of automatic and semi-automatic plating equipment, this fault has been remedied. Plant engineers have devised many ingenious methods of conveying work to and from the plating room, thereby speeding up production and considerably reducing the time of work in process, in some instances as much as 60 per cent.

The tendency toward the employment of automatic equipment for plating purposes is now making itself felt in large plants where all plating is done in plating barrels. This is true particularly of manufacturers of such products as nuts, screws and bolts—articles too small to rack or wire. Instead of operating a group of individual plating barrels, these companies are now installing multiple plating machines which consist of a single large tank containing from six to nine compartments with an overhead monorail and hoist to lift the cylinders from one compartment to another.

Among the metals suitable for plating purposes, chromium, cadmium and zinc seem to hold the widest interest. However, most attention centers on chromium. It is now a generally accepted fact that good chromium plating, where it is applied principally for the sake of an attractive appearance, requires good nickel plating as a base. This has been accepted by the major users of chromium, particularly the automobile industry.

Heavy Nickel Deposit Needed as Base for Chromium

It was thought at first that chromium over a light nickel deposit would give the required protection and the beauty of color so much desired. This proved to be incorrect, however, for the value to be obtained from a chromium coating was thereby either reduced or entirely lost. Many manufacturers, as a result, are demanding a heavier and much better deposit of nickel as a base for chromium.

The use of cadmium increased substantially during 1929. This metal is being adopted by many industries to prevent corrosion. Zinc, too, is growing in popularity and preliminary tests indicate that electro-deposited coatings of zinc give better protection against corrosion than hot galvanizing of the same weight.

There is another phase of metal finishing that cannot be overlooked, that is, polishing metal prior to and after plating. Little scientific data have been collected with reference to these important operations. There are no standards. Every shop has its own pet methods and preferences. However, the impressive progress made in plating is causing production executives to turn to polishing and buffing to learn how these operations should be performed.

Much money is being spent needlessly on polishing because engineers have not yet devised economical methods of doing this work. A thorough study of lathe speeds, selection of proper wheels and buffs and the use of buffing compounds which will cut rapidly and clean off easily in the cleaning solution, would help materially to lower costs and improve the final finish.

Rapid Strides Made By Welding

Economic Repercussions on Pipe Manufacturing, Structural Engineering and Iron and Steel Foundries—Many Weldable Alloys Now Produced

BY E. E. THUM



WELDING, to the average citizen, means a fascinating play of hot flames, and can be seen in repair shops down the side streets. Yet it is safe to say that this modern successor to the village smithy does less than 5 per cent of the welding. The shops are numerous, but their activities restricted. Since they never get into mass production, it's another instance of a large majority of the establishments doing an almost negligible proportion of the aggregate business.

Contrasted with this is the amount of cutting and welding equipment and gases used in smelters, iron and steel works, rolling mills and foundries. Its total approaches half the production of the entire welding industry. And the effects of welding on one branch of the iron and steel industry, namely pipe manufacture, constitute the most noteworthy feature of the present situation.

Competition Between Arc Welded and Lap Welded Pipe

MASS production by fusion welding methods began some years back, and (while it is always difficult to assign definite priority) probably consisted of the manufacture of thin walled mechanical tubing with longitudinal joints welded in an automatic machine with oxy-acetylene flames. Such tubing is still made in quantity, but the effect of this new method on other pipe-making processes has been not inconsiderable, since it built a new market for its products, and the older competing material, cold drawn seamless tube, was itself a minor specialty.

But the advent of electrically welded pipe of large size (8 to 30 in. diameter) and the simultaneous rapid expansion of trunk lines for transportation and distribution of petroleum and natural gas, reacted on established industry in an entirely different fashion. In this development the A. O. Smith Corporation has taken the lead. Its manufacturing methods are such that a joint which approaches 100 per cent efficiency is rapidly made, enough better than the strength of the conventional lap welded joint to permit a reduction in wall thickness of pipe for equivalent pressure. Such economies in the weight (and cost) of steel pipe are very attractive to builders of long trunk lines, and have diverted extremely large tonnages to the electric welded product.

In order to meet this competition, organizations with extensive plants devoted to the older methods of manufacture have engaged in an intensive study of their processes, with the result that the quality of the lap and butt joint have been improved and the cost of manufacture reduced. New capacity for electrical welded pipe is also being built by both the Republic Steel Co. and the National Tube Co., Steel & Tubes, Inc., a subsidiary of the former, has been manufacturing pipe up to 6 in. diameter by methods similar to electrical resistance welding, and sufficient experience gained to warrant the construction of a manufacturing plant for larger sizes.

Jointing this pipe in the field has occupied a major proportion of the attention of welding equipment manufacturers. Notwithstanding the efforts to develop satisfactory arc welders, portable and rugged enough for field operations, and a type of bell and spigot joint especially suited for electric welding, the plain butt joint, welded with an oxy-acetylene blowpipe, continues the favorite tool of pipe workers. Particularly notable is the efficiency of construction organizations that can clear the right of way, dig the trenches, distribute and weld the pipe, back fill the trenches, construct pumping stations and deliver the line to the owners at the rate of 100 miles per month.

Is Structural Welding a Disturbing Factor?

TWO powerful influences are operating to place structural welding into the roster of good practices accepted by civil engineers. The first is the economy with which existing structures (particularly railroad bridges) can be strengthened. Extra metal can be welded into the steel work, where the members have been weakened by corrosion or are overloaded by heavier rolling stock, with the greatest ease, without interfering with traffic and at not more than one-fifth the cost of taking away the old structure and building a new one.

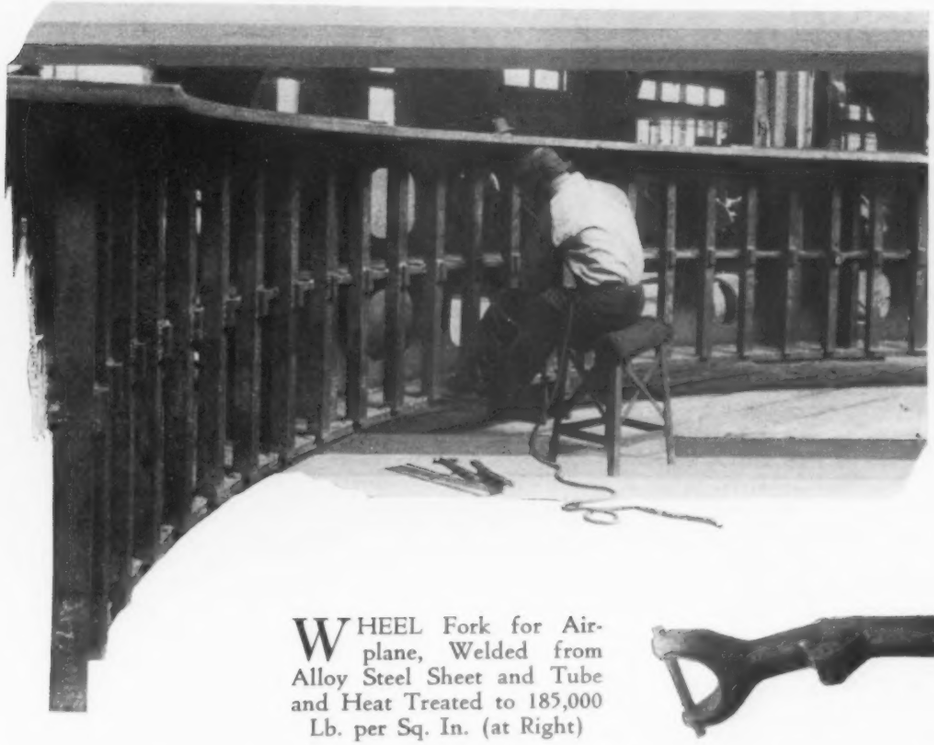
The second factor forcing welding upon the structural engineer is a popular revolt against noise in densely populated districts. Several notable additions to hotels, hospitals and business buildings have been erected with welded field joints, and the owners have been justified in assuming an added expense, since tenants in existing structures have not been disturbed.

Whether the cost of welding a joint in the field is inherently greater than the cost of driving sufficient rivets into properly matched holes cannot be stated. At the present, a new process with some general-purpose equipment and inexperienced workmen is competing with an established and highly specialized trade. It therefore is not surprising that the justification for welded structures must come from collateral advantages.

From the structural fabricator's standpoint, these have already appeared in the ability to ship a considerable proportion of the beams for a tier building from the rolling mill direct to the site. Revision in details also simplifies routing of those members that must be handled in the fabricating shop, puts the bulk of the machine work on light members, and reduces their number. Welded field joints also promise considerable savings in weight, since beams, columns and (with steel deck floors) even the entire structure can be figured as "continuous," acting as a unit, and distributing concentrated loads to many neighboring supports.

Two other factors limiting the more rapid development of structural welding are being removed by activities on the part of the American Welding Society. Extended research into the properties of welded joints in shapes and plates is being conducted by that society, generously supported by many interested firms. In the coming year this will undoubtedly yield the engineering data necessary for proper design of the joints. A second matter is the existence of building codes, so written as to prohibit any but conventional constructions, and the American Welding Society is also at work in formulating a permissive code.

From an economic standpoint, the well established fabricators may expect an increasing amount of competition for the simple structures from "shoe-string" organizations. With an oxy-acetylene cutting machine, an electric welding unit and a portable drill installed in a convenient shed (the whole layout costing under $2,000), resourceful mechanics can fabricate almost any building frame now working its way through regular fabricating shops filled with punching, drilling, coping, riveting and milling machines costing a hundred times as much.



GENERATOR Frame, 33 Ft. Diameter, for Hydroelectric Installation, Is of Steel Bars and Plates Assembled by Welding

WHEEL Fork for Airplane, Welded from Alloy Steel Sheet and Tube and Heat Treated to 185,000 Lb. per Sq. In. (at Right)

Saving Weight on Ships

WITH the revival in shipbuilding, an increasing amount of welding may be expected in that industry. New construction and repairs have always been generous users of the cutting flame, and the Newport News Shipbuilding & Dry Dock Co. has been a conspicuous leader in the application of welding to new ships. Naval architects, ship owners, and insurance companies, however, have been slower to authorize the use of welded construction and stronger structural steels than have their competitors in England and Germany. In the latter country, by the use of high elastic limit steels and by eliminating redundant metal through welded joints, war ships have been constructed without disturbing armament and cruising radius in respect to the treaty limit for weight. Alfred Holt & Co., in England, has also discovered that it pays to save dead weight in cargo vessels (even though it is done largely by the use of stronger steel). These foreign developments undoubtedly point the way for future changes in our own industry, reasonably to be expected. A particular application—welded tank tops for lake ore boats—has proved its ability to withstand the punishment of loading and unloading machinery.

Substitution of Welded Steel for Castings

MAKERS of machines for cutting irregular shapes automatically to pattern by means of the oxy-acetylene flame report an unusual expansion in business. This reflects the increasing use of welded steel in place of iron and steel castings. Wide publicity has been given in the months past to this development by General Electric Co. and Westinghouse Electric & Mfg. Co. Both these firms have found that much large equipment can be better made of fabricated steel, that the joints are sound and reliable, and that the expense of patterns, made especially for a single order, is avoided. The Lincoln Electric Co. has found these economies to extend to machinery of smaller size. The idea is extending in industry generally; steel is replacing cast iron for massive bed plates designed to resist bending, and such things as press and shear frames which have high tension stresses in them. Doubtless this substitution will continue, especially since recent developments promise means whereby the electric weld is much improved in soundness and ductility. Substitution of steel for cast iron is especially attractive where considerable weight can be saved and extreme rigidity is not necessary, and where only a few castings are required from elaborate patterns.

New Alloys Now Must Be Weldable

AS if the various demands for ductility, strength, toughness at high temperatures, and resistance to corrosive solutions were not sufficient to tax the resourcefulness of metallurgists, it is now necessary that metals for petroleum, chemical and food handling equipment shall also be weldable. As a matter of fact, such alloys

are being produced—notably, the austenitic chromium-nickel steels—and their expanding popularity is in no small measure due to the ease with which autogenous joints may be made in diverse equipment.

Welding of those alloys which are properly used in a heat-treated condition is a recent development which will undoubtedly be further extended. During 1929 the aircraft industry became standardized on the welded fuselage made of chromium-molybdenum tubing. Advantages of this construction over the older wood and wire composite have been stated so often that they need not be repeated. The future will doubtless see a larger and larger proportion of the wing structure welded, in units small enough so they can be made of alloys other than the air hardening tubing used in the long rangy fuselages, and the fabricated part heat treated as a whole. Heat treatment of welded assemblages is, in fact, no great novelty.

Intensive investigation of the possibilities of welding the hardenable aluminum alloys of the duralumin type also encourages the prediction that spot welding will be on the increase, either made by methods and at such a speed that the surrounding metal is reheated to a minimum depth, or by the installation of heat treating equipment large enough to temper an entire structure or assemblage.

Present and Future of Nitriding

Causes of Failures—New Hardening Steels Will Probably Be Developed—Other Materials May Be Nitrided

BY V. O. HOMERBERG

INCREASING interest in the development of the nitriding process and in the commercial applications of nitrided materials was clearly demonstrated at the symposium on nitriding which was held last September at the National Metal Congress in Cleveland. The great advance which has been made in this very important metallurgical development, since its introduction into this country about three years ago, was apparent to all of those who attended this session.

The study of the process of case hardening special alloy steels with ammonia gas has been ably studied by many investigators in this country since its introduction from abroad. The results of their work have converted the applications of the process from an experimental basis to one of great commercial significance.

The Ludlum Steel Co. was the original licensee in this country for the manufacture of the special alloy steels and for the use of the nitriding process. A great deal of credit must be given to H. A. De Fries and to Dr. J. Norton, two members of the technical staff of this company, for their original investigative work, including not only the successful manufacture of the steel both by the basic electric and by the basic open-hearth process, but also the solution of many of the difficulties encountered in the application of this method of case hardening.

Early Attempts to Nitride

Introduction of the process into this country several years ago immediately created a great deal of interest with the result that Dr. Norton was deluged with articles of every description to be nitrided. Many of them had been made in a haphazard manner. Generally no attempt had been made to remove internal stresses and, as a rule, the articles were in the annealed condition as well as often decarburized.

Failures of many of the nitrided articles, which were nitrided under these conditions, obviously created a feeling of skepticism as to the suitability of the process and the applicability of the treated articles to commercial purposes.

The first great accomplishment in the manufacture of the steel involved the successful introduction of a predetermined amount of aluminum. The next important step was the manufacture of the aluminum-containing steels in the basic open-hearth furnace in order to lower the price of the product.

Successful solution of many of the problems investigated in 1929 has greatly enhanced our knowledge of the nitriding process. It has been definitely determined that chipping of the case and the production of an exceedingly brittle surface condition always accompany the nitriding of decarburized material. It has been demonstrated also that the nitriding process is not inflexible but that the characteristics of the nitrided case can be altered somewhat by varying the temperature of nitriding and by the use of a double temperature cycle.

Sorbitic Steel Necessary

The outcome of another important investigation has resulted in the recommendation that all articles should be heat-treated to the sorbitic state before nitriding since the temperature used in accomplishing the surface hardening of the steel does not affect the original grain structure. A coarse grain structure, together with extreme hardness, makes the treated article susceptible to flaking or chipping of the surface.

Although investigations have been made involving steels other than those containing aluminum, it has been clearly demonstrated that those containing this element possess a range of properties not shown by those steels in which it is absent.

The interest shown by furnace manufacturers has resulted in the development of equipment specially designed for nitriding. The use of a fan within the furnace to produce active circulation of the ammonia gas has proved to be beneficial in insuring uniformity in the quality of the case.

Developments Predicted for 1930

A NUMBER of interesting developments can be predicted for the coming year. Many of them are under investigation in the author's laboratory. It is believed that the time of nitriding necessary to produce the desired results will be greatly shortened. The use of pressure appears to be an important factor in accomplishing this result.

At the present time, most of the failures of nitrided

materials may be attributed to the lack of proper precautions to insure the absence of decarburization in articles to be nitrided. The nitriding of decarburized material always leads to the production of a brittle case. Dr. Walsted and the writer have found that it is possible to introduce carbon and nitrogen simultaneously at a temperature considerably below the lower critical point of the steel. The application of such a procedure will eliminate the danger now experienced in the nitriding of decarburized articles. A paper on this phase of the subject will be published in the near future.

New Nitriding Steels Will Be Developed

New steels will be developed to meet the various requirements of the industries. Also, materials other than steel will be developed for nitriding, the commercial applications of which are immediately apparent. Mr. Coonan and the writer have already obtained positive results in this direction.

The use of nitrided articles has conclusively demonstrated the valuable properties of the nitrided case. The amount of material manufactured and the extent to which nitrided materials will be used industrially will be greatly increased during 1930. Investigations are proceeding at a rapid rate, the results of which will be of far-reaching importance to the various industries.

In conclusion, the writer wishes to emphasize again the indebtedness due Mr. De Fries and Dr. Norton, who acted as pioneers in the successful manufacture of the steels containing aluminum and in the study of the nitriding process in this country. They paved the way for investigations which have followed their patient work since the introduction of this very important metallurgical development from abroad.

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Strides Made in Aluminum Industry

Structural Shapes 90 Feet Long a New Development—Larger Use in Aircraft—Important in Architecture

DEVELOPMENT of a process for manufacturing structural shapes having the strength of mild steel and the lightness of aluminum was the outstanding feature in the aluminum industry during the past year.

To meet the demand for this product, the Aluminum Co. of America has constructed a blooming and structural mill at Massena, N. Y., which will produce aluminum alloy structural shapes 14 in. deep and 90 ft. long. The new mill will take blooming ingots weighing 2000 to 3000 lb. To perfect a casting process for the large ingots and to design proper heat-treating equipment for the structural shapes were important problems which have been solved.

Production of aluminum alloy structural shapes has opened up new fields for the application of aluminum alloys. In the motor truck and street car manufacturing industries, the use of aluminum has been somewhat limited because large structural shapes could not be obtained. Now that this difficulty has been overcome, the tonnage of aluminum products going to these two branches of transportation is expected to show a substantial increase.

Structural shapes also have been used successfully in the construction of cranes. In the case of a 10-ton crane, for example, about 50 per cent of the weight is saved, it is claimed, by the substitution of aluminum for other metals, the reduction in weight resulting in lowered operating costs and good general performance.

In the aircraft industry aluminum gained further recognition the past year. Its increased use is attributed to the gain in the number of planes manufactured and to the growing favor of all-metal construction. The metal clad dirigible ZMC-2, recently built for the United States Navy by the Detroit Aircraft Corporation, is a new development in lighter-than-air craft. This ship not only has a framework fabricated from strong aluminum alloys of the duralumin type, but also is covered with Alclad aluminum sheet instead of fabric. As pointed out in THE IRON AGE of Aug. 22, 1929, p. 453, the Alclad aluminum sheet employed for the covering consists of a core of strong alloy sheet with integral surface layers of aluminum.

Another field in which aluminum is gaining is in the exterior and interior ornamentation of buildings. This is due owing to its resistance to atmospheric corrosion and to the fact that it is found not to form colored compounds which can streak or stain the structure on which it is placed. The two largest applications of aluminum for this purpose are on the Chrysler Building, New York, and the Cathedral of Learning, Pittsburgh.

On account of the resistance of aluminum to hydrogen sulphide, aluminum equipment is being used in the oil fields of western Texas and the Panhandle district. Aluminum cable is being employed for the transmission of power and for swing lines inside of storage tanks. Several aluminum tanks have been in operation for nearly two years. The application of aluminum paint to oil tanks is well known. Aluminum foil is used for preserving steel and wood in the oil fields and refineries.

The widening use of heat-treated aluminum alloy castings and forgings in aeronautics has revealed the need of internal inspection, which has been accomplished by means of radiography. In the past year X-ray equipment has been installed in two plants of the United States Aluminum Co. for that purpose and for research work.

Spot welding has progressed to the point where it is replacing riveting in the fabrication of aluminum cooking utensils. Developments also indicate a more satisfactory application of arc and butt welding in connection with the manufacture of aluminum products.

Grinding Machine Developments Continue

Precision Types Giving Higher Production and Closer Accuracy, While Hand Grinders Are Stronger and Safer to Operate

BY H. G. WEINLAND*

EACH year brings new developments and improvements in all the phases of grinding, one of the great arts of the twentieth century, but the past year has seen more and greater advances than any heretofore. Users are beginning to appreciate the real value of grinding, and to realize that in many cases it is the cheapest and best method of producing a good job, whether it be on hard or soft material. It must be said, however, that if the manufacturers of grinding wheels had not earnestly cooperated in the improvement of their product, the grinding machinery manufacturer would not have been able to show such satisfactory results.

Purchasers of precision machines are constantly demanding greater production with closer accuracy, and this dual aim naturally calls for the complete redesign in many instances, and radical changes in others. These aims have been accomplished by the use of more massive structures with better design and workmanship, which factors make the equipment command higher prices but in the long run result in cheaper operation. Application of hydraulic feeding on long-stroke machines permits higher traverse speeds, thus permitting use of slightly harder grinding wheels with less wheel wear per unit of work produced.

These improved results have also been aided by the newer and better balanced motors and better types of drives, such as multiple V-type belts and improved silent chain, which provide positive as well as non-vibrating transmission of power.

The trend of development in the smaller precision machines of the cutter and reamer grinder class has been toward greater ease of handling, as well as improvements in accuracy and stability. With the attachments which may be had with these machines almost any type of small or medium size tool may be made or conditioned.

Important Changes in "Hand" Grinders

In the free hand grinding class of equipment important changes have been made in the design of machines. These include greater weight, better bearing application and better workmanship, all of which lead to steadier running wheels, and thus to greater safety and wheel economy. Steady running wheels have a tendency to wear out rather than beat themselves to pieces on the work.

Devices to prevent over-speeding and under-speeding of grinding wheels have been applied to the modern machines. Such devices assure greater safety of operation and promote greater economy in wheel consumption, with resulting lower grinding costs. With these safety features the attitude of the operators is improved to such an extent that the increased production quickly pays for the added investment.

Motor-driven suspended grinders that are extremely light in weight (considering wheel size and speed) but at the same time very rugged, have been developed. These machines can be operated with ease by men of average size, and in eliminating the need for operators of the "physical giant" type, they will be appreciated by superintendents and foremen who can use skillful men, regardless of size as operators.

Constant developments in pneumatic grinders have produced machines with remarkable power, mechanical strength and stability, which make them especially efficient in the grinding of all types of work not readily accessible with a larger wheel and machine. These machines have an advantage over the motor-driven types due to their lighter weight and smaller body of motor, which permits their use in limited spaces, as well as the use of smaller wheels operating at the proper peripheral speed.

Many Improvements Due to High Wheel Speeds

Many of these improvements and developments are due to the increasing use of higher surface speeds on the grinding wheels. This is true with both the moderate and so-called high-speed wheels. It would be foolhardy to think of running a grinding wheel for free-hand grinding at the commonly accepted present-day speeds on a machine with any other than some type of anti-friction bearings, either of the ball or roller bearing type. Machines with bearings of this type have been run for periods as long as one year with a single oiling, have had no maintenance cost in five years and have shown savings as high as 35 per cent in the wheel cost, not to mention the saving in the power consumption.

Consideration of higher speeds causes us to remember that not so long ago good safe practice indicated "a mile a minute" as a proper surface speed and that even with this slow speed accidents were not uncommon. Operating speeds have been gradually increased to higher figures with attendant economy, but while it is approximately true that the cutting capacity is directly proportional to the surface speed, yet the constant stepping up of operating speed should be done with increasing caution. Practice proves that it is not always the highest speed that does the best or most work, and a lower speed may meet all the requirements with a greatly lessened hazard.

The so-called high-speed wheels, those operating at approximately 9000 surface ft. per min., have demanded use of anti-friction bearings, greater power capacities, heavier machines covering greater floor space to increase stability, facilities for speed changes to compensate for wheel wear and approved safety devices, as well as fine workmanship and design. These demands have been competently met by many producers of this class of equipment.

The high-speed type of wheel is now being used to some extent on cylindrical, face and surface grinders with satisfactory results where the design of the machine permits the proper increase of speed. It is not to be recommended at the present time in the smaller sizes for precision work where the rotative speed is of necessity very high to obtain the proper peripheral speed.

New problems are constantly being presented for solution in grinding different materials with this new type of wheel, and are in most cases being solved satisfactorily. It may be assumed that improvements and new developments may be expected to keep pace with demands during 1930. Some radical deviations from conventional practice may be looked for.

*Secretary Safety Grinding Wheel & Machine Co., Springfield, Ohio.

Advances in Non-ferrous Field

New Copper Alloys and Larger Consumption—Greater Use of Nickel in Alloys and Steel—Hard Facing Metals

BY W. M. CORSE*

UP to and including October, 1929, business in the non-ferrous metals industry was extremely good, though in common with everything else it showed a definite recession in the last two months of the year. However, an analysis of the different branches of the industry indicates a distinctly favorable outlook for 1930.

Copper—Greatly Increased Consumption in Sight

CONSUMPTION of copper in the United States is highly significant of the trend and tendency of the times. Available figures show that the yearly per capita consumption has increased from 8.49 lb. in 1921 to 17 lb. plus in 1929—figures for the latter part of the year not being available. The use of copper has more than doubled in nine years since it became a peace-time industrial material.

The many and varied uses to which copper has been put guarantees a regular consumption, and it is estimated that the public utilities alone will purchase 1,000,000,000 lb. in 1930 or 50 per cent of the entire domestic consumption. Closely following the public utilities in the use of copper is the field of building and construction where copper and brass for piping, roofing, flashings, screenings, gutters, leaders, wiring, plumbing supplies, laundry equipment, refrigeration units and oil burners will consume tremendous quantities. It is estimated that 50,000,000 lb. of copper will be used in the manufacture of refrigerators, while the washing machine and oil burner industries will consume 15,000,000 lb. each.

Perhaps the newest large use for copper is in radiators, the use of which is coming rapidly to the fore. The Fisher Building in Detroit, one of our most modern structures, is entirely equipped with them, and they are proving so satisfactory that it is estimated that the amount of copper consumed in this field will be about 100,000,000 lb. per year inside of a three-year period.

Marine Industry

The marine industry is also becoming a large potential market for copper as the surplus ship tonnage built during the war has been absorbed or otherwise used up. In this field the comparatively new copper-silicon alloy, "Everdur," is making marked headway for nails, bolts, etc. "Tempaloy,"—a high-strength high-copper alloy bearing the same relation to copper that duralumin does to aluminum—in that its strength is due to heat treatment known as aging—is beginning to make a place for itself in the engineering field. This alloy was developed by the Union Carbide & Carbon Research Laboratories a few years ago and wrought metal rights are now controlled by the American Brass Co. This composition and its various modifications bid fair to give us some of the highest strength copper-base alloys thus far discovered.

*Consulting metallurgist, Washington.

The automobile industry due to curtailment because of over-production, will use approximately 150,000,000 lb. of copper in 1930 as against 250,000,000 lb. in 1929. The radio industry will also use less.

Railroad Electrification of Track

It is estimated that the railroads will use at least 15,000,000 lb. for electrification of tracks, in addition to the 50,000,000 lb. or 100,000,000 lb. ordinarily used in cars, buildings and other equipment. In addition to the millions of pounds to be used in electrification of the railroads, there will be large quantities consumed in industry, farm uses, wiring of homes, etc.

New sources of supply are being placed in commission. In December the Nichols refinery was opened at El Paso. The Ontario Refining Co. is erecting a new copper and nickel refinery at Copper Cliff, Ontario, while the Canadian Copper Refiners will soon start the construction of a new refinery at tidewater in Eastern Canada. These three plants will add 300,000 tons refining capacity to the continent's facilities.

Nickel—Many New Uses Increase Quantity Used

IN keeping with the trend of the last several years, the consumption of nickel showed a substantial increase in 1929. Of prime interest to the consumer is the much enlarged production of higher purity electrolytic cathode reported by the International Nickel Co. for use in alloy steels and nickel alloys, which makes available a form of nickel much purer than furnace products heretofore available. This trend toward high purity in nickel should stimulate production of new and higher quality nickel alloys.

There has been a marked increase in the use of nickel in the construction of evaporators for caustic soda and in sheet for lining settling tanks and solution heaters. Nickel sheets and tubes are growing in demand for the production of cellulose acetate, both for photographic film and for rayon.

The largest field of consumption of nickel is that of the alloy steels for railroad equipment, agricultural implements, tractors, road building, contractors' equipment, mining machinery and oil field equipment. The automotive industry has used increasing amounts of nickel in heavy duty units such as tractors, trucks and buses, in the form of nickel steel, and indications point to the fact that the coming year will show a considerable use of stainless steels such as "18 and 8" (containing nickel) for trim. Chrome plate has increased the tonnages of nickel used in electroplating, due to the high qualities of chrome plate superimposed on heavy coatings of nickel.

Use of nickel in improving the quality of cast iron has continued its growth and the past year has found this alloy invading new fields such as lathe and planer beds, gears, spindles and rams. One manufacturer of nickel-chromium cast iron has manufactured for the

United States Government 6-in. high explosive projectiles. The alloy has found its way into the household during the last year in the form of cast iron gears for washing machines, while gas compressors in practically all refrigerating machines are now made of nickel cast iron. It is used also on the indexing gears in dial telephones.

Utilization of nickel in brasses, bronzes and aluminum shows some promise. Nickel-silver continues to be a substantial and growing field, especially in plumbing fixtures of 20 per cent nickel content, such as those being specified in the monumental buildings projected and being built by the United States Government throughout the country. One manufacturer made last year 200,000 castings of plumbing fixtures.

Monel metal is the most widely used of the high corrosion-resisting nickel alloys, and it shows a considerable increase both in the quantity used as well as in the number of applications. One of the most interesting developments was its introduction into the household in form of kitchen sinks, tables, drainboards and in architectural metal work. The consumption of Monel metal increased in fields such as food handling and service, soda fountains, the paper industry, ventilating apparatus, fire extinguishers, chemical uses, electrical equipment, steam power, laundry and dyeing machinery as well as steel pickling. The manufacture of certain types of apparatus and shapes has been so governed as to obtain higher strength and greater elasticity of properties than were formerly available. The corrosion resistance of this metal is not impaired by cold working which produces high mechanical properties.

Hard Facing Metals—"Hascrome," a New Development

SINCE the discovery a few years ago that Haynes stellite could be readily applied over a steel surface by means of an oxyacetylene torch, its uses for putting on a hard, non-corrosive surface have been increasing rapidly. Many completed tests, where stellite has been applied, show a saving from 3 to 5 to 1 over plain untreated surfaces. It is, however, a relatively expensive material which has somewhat restricted its use for thick coatings.

However, where thick coatings are necessary, a new product of the Haynes Stellite Co. known as "Hascrome" has been produced recently for building a work-part back to original size before hard facing. "Hascrome" is a chromium-manganese-iron alloy and furnishes strength and toughness. It can be used to hardface steel and cast iron. The deposit has a tensile strength of 40,000 lb. and a compressive strength of 177,000 lb. per sq. in. It can be forged and ground but not machined. Its comparative inexpensiveness makes the building up of a wear-resisting surface a practical everyday operation at a reasonable cost to the user.

A New Alloy—Not Attacked by Hydrochloric Acid

TO the chemical engineer who has had to handle hydrochloric acid or highly corrosive products containing chlorides, the procuring of metal for his apparatus has been a difficult problem. The handling of nitric and sulphuric acids had been accomplished, but until the last year it was difficult to handle hydrochloric acid in metal containers. However the development of the nickel-molybdenum-iron alloys with modifications by the Union Carbide & Carbon Corporation, and their production on a commercial scale in the form of an alloy known as "Hastelloy," by the Haynes Stellite Co., will enable the chemical engineer to handle this difficult material more readily. "Hastelloy" was available in comparatively small tonnages during 1929, but the company is building a new plant especially to take care of increased business, and 1930 will see facilities for providing the chemical engineer with his requirements.

Lead—New Uses and New Alloys

A COMPREHENSIVE research program is finding new uses daily for lead. A lead-calcium alloy, having high fatigue strength, has been developed and is being used for cable sheathing. Lead-lined articles are being more and more used in chemical equipment, and their use would be wider if their cost could be reduced. Antimonial sheet lead is being used for tank linings for chromium electroplating solutions, and hundreds of lead-lined tanks for chromium plating have given satisfactory service for some time. Spaces inside of trolley car gear wheels are partially filled with lead which serves as a silencer to reduce noise, and pulverized lead on brake bands of taxis now reduces the squeal.

A new solder for electric motors, developed by the Westinghouse Eletric & Mfg. Co.—composition 2.50 silver; 0.25 copper; 97.25 per cent lead—is said to be good for higher temperatures than ordinary solder and even better than low-tin high-lead alloy. Lead is also being used to cover the heads of roofing nails, and is being reinforced with steel or brass for handling chemicals. The use of lead anodes, containing 98.8 per cent lead, 1 per cent silver and 0.2 per cent arsenic, has resulted in the commercial production of an electrolytic zinc of exceptional purity. Studies are going on pertaining to the use of lead in bearing metal alloys and the Bureau of Standards is making a study of lead-base babbitts at the request of the Assistant Secretary of War in view of the possibility of substituting these metals for tin-base metals in order to conserve tin.

Silver Solder—More Used in Refrigeration

IN general there has been much change in the silver solder field. The newest increasing use of this material is in connection with household refrigerating units. In all places where it was already in use the increased consumption was marked in 1929, owing to expansion especially of the automobile and airplane industries. It is used successfully with Monel metal, nickel-silver, nickel, brass and bronze, copper, iron and steel.

Bearing Metals—Higher Melting Ones to the Front

THE demand from the engineer, both automotive and aircraft, for bearing metals to withstand higher pressure and temperatures is bringing to the front metals having higher melting points than the ordinary babbitts, which have been used to such a large extent for lining metals for these surfaces. Copper-tin-lead alloys with relatively high lead content have been used in the past, but never have been widely adopted, and the development of a bearing metal with a higher melting point than babbitt with good bearing properties is in constant demand by engineers.

Zinc—Greater Use in Die Castings

THE regular and existing uses of zinc have shown the same development in 1929 as those of other metals, but new uses seem to be difficult to unearth. However, from recent reports the use of very pure zinc in the die casting field is proving successful, and this may lead eventually to a revival of interest in fields abandoned in the past due to failures under certain conditions.

Research has broadened so in the last year and the possibility of new developments has so increased that even more interesting facts may result from the investigations of workers in this field in 1930. The older research laboratories are seasoned in their activity and recently there have been new ones organized which, with the work of such institutions as the one engineered by the copper and brass producers, may unearth alloys or other products of vital interest to industry.

Tungsten-Carbide Tools Increase in Use

Introduced a Little Over a Year Ago, They Prove Economical on Cast Iron, Non-Ferrous and Other Materials

SINCE their debut in America a little over a year ago, tungsten-carbide cutting tools have been taken up by industry and tried out for whatever production economies they might make possible. On some materials, including several that formerly were non-machinable, their value was immediately recognized; on others considerable experimenting has been necessary. Although still in their infancy, these tools have made a substantial start, and will no doubt occupy an increasingly important place in metal-working shops.

Under date line of Hamburg, Germany, March 1, 1927, THE IRON AGE published news of the development of Widia metal by Fried. Krupp, A. G. The next news came about 18 months later (September, 1928) in the form of a description of Widia and an announcement of its importation into the United States by Thomas Prosser & Son, New York. Shortly after, Carboloy was announced by Dr. S. L. Hoyt of the General Electric Co., in an address before the Philadelphia convention of the American Society for Steel Treating, Oct. 8-12, 1928. Demonstrations of these tools at the exposition held in connection with this convention were a source of unusual interest and comment.

With this start abut 15 months ago, the news quickly spread through newspapers, trade and technical journals and expositions and demonstrations by the makers and their agents. Machine tool builders were quick to take cognizance of the possibilities of these tools and the changes in design that it might involve. Some of them in fact had seen this material in Germany and in England before its importation into this country and had secured samples for experimental purposes. Machines designed to use these tools appeared in short course, at the Machine Tool Show in Cleveland last fall.

In the meantime other sources of supply became available, until now tungsten-carbide tools in cemented or cast condition are being offered by several companies under trade names as follows:

Carboloy, Carboloy Co., New York.
Camite, Cleveland Automatic Machine Co., Cleveland.
Firthite (formerly Dimondite), Firth-Sterling Steel Co., McKeesport, Pa.
Haystellite, Haynes Stellite Co., Kokomo, Ind.
Strauss metal, Ludlum Steel Co., Watervliet, N. Y.
Widia, Thomas Prosser & Son, New York.
Widia wire drawing and extrusion dies, Union Wire Die Corporation, New York.

Haystellite is a cast material, recently announced, and is claimed to have the same properties and uses as the cemented product.

Many Carbide Tool Problems Solved

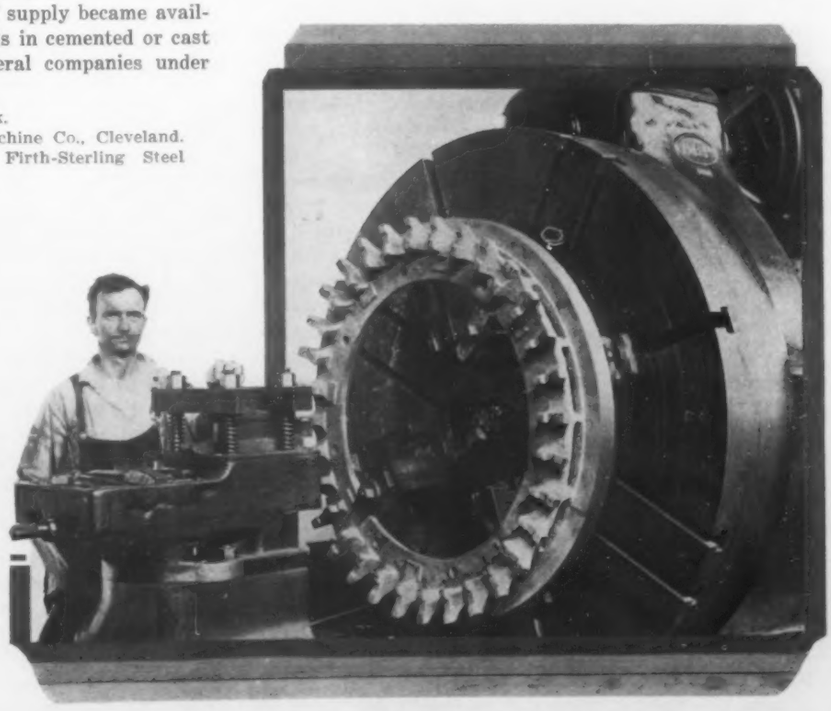
The grinding and lapping of cemented tungsten carbide at first presented difficulties, but with the development of suitable wheels, of silicon carbide, these difficulties were overcome. Several tool grinders adapted for these tools are now available, and at least one of these provides for rough and finish grinding and lapping on the one machine.

Tool angles and shapes (which differ from those of high-speed steel) have been worked out and data on the recommened angles for various materials and conditions has been published by the producers of tungsten carbide. The shank of the tool is generally tool steel.

Three methods of attaching the carbide tip to the steel shank have been used. These are brazing, atomic-hydrogen welding and mechanically, by dovetailing. Brazing is at present the most commonly employed.

Turning and Boring Major Applications

Tungsten carbide was first applied to lathe-type tools for turning and boring operations. They include forming, parting, piston grooving and similar forms. Twist drills and reamers tipped with this material are also available. Other applications include milling cutters and broaches, and one company has developed a carbide tipped inserted-



TUNGSTEN-CARBIDE Tools Are Used in Machining This Cast Iron Armature Flange. Operations consist of facing the lugs, machining the inside diameter of the lugs and the outside and inside diameter complete. Ten pieces are machined per grind against ¼ piece previously and production per week stepped up from 12 to 27 pieces. (By courtesy of the Carboloy Co.)

tooth saw for abrasive non-metallics, aluminum alloys and other materials. Wire drawing dies have been an outstanding application. There have been a few applications to blanking dies, and grinder steadyrests. Snap and other types of gages using tungsten carbide have also been developed.

At first the tungsten-carbide tools attracted attention in machining abrasive materials that quickly wear away the cutting edge of ordinary tools but which do not exert great pressures on the tool. Such materials were hard carbon, Genelite, Mycalex, bakelite, some grades of hard rubber, glass, green porcelain, etc. They also attracted notice in machining Hadfields manganese steel, hard and dense cast irons, aluminum alloys, and bronzes. Advantage was seen in the ability of these tools to make intermittent or jump cuts on slotted bars, castings with blowholes, etc., but in this proper tool support and great rigidity are essential.

Although there have been successful applications in machining both low and high alloy steels, in general steel seems to be the most difficult field for this new material. Success in this field seems to depend on such factors as rigidity of the machine tool, ample power, proper support of the cutting tip in a sufficiently heavy shank, and minimum of overhang. In some of the cemented tungsten-carbide tools, two grades, for different classes of materials, are at present available.

With the tool correctly ground and supported, the most important factor in all applications is the feed, the tools requiring lighter feeds but higher speeds than high-speed steel. Limitation to the lighter feeds (up to 0.040 in.) is due to their comparatively lower strength.

Viewpoint Changes to Production Uses

In the field of machining, interest has shifted somewhat from spectacular prformances to applications invloving large-scale production work on everyday materials. Economical use of the material is now being considered from several angles: First in making available materials heretofore classed as non-machinable, such as the new "Lo Ex" aluminum alloy used by the Reo Motor Car Co. for pistons and which could not be employed until some means was found for machining them commercially. Secondly, the material may be used to secure larger output through higher cutting speeds, the feed and cut remaining about the same as before. A third source of economy is securing greater tool life between grinds, such as in automatic screw machine work, where making tool set-ups is an important cost factor. A fourth is lengthened life of tool.

Fuels for Heat Treating

Trend Is Toward Refined Sources—Two Important Developments in 1929—Gas and Electricity Expand Despite Lower Cost of Oil and Coal

BY ROBERT M. KEENEY*

DURING 1929 the trend toward the use of the more refined sources of heat, electricity, gas and oil for heat treatment, which has become more definite each year, continued at an increasing rate with a very pronounced upward trend in the use of manufactured gas and electricity. This upward trend in the use of gas and electricity persisted in spite of a generally lower price for the competitive fuels, oil and coal. The lower price level of these fuels, established in 1928 by a decline from 1927 price level of 28 per cent in the price of fuel oil, of 7 per cent for bituminous coal and of 5 per cent for anthracite coal, continued through 1929.

Larger Use of Gas and Electricity

The increasing use of manufactured gas and electricity for industrial heating during the past six years is indicated in the illustration. The use of manufactured gas for heat treating and other industrial processes is estimated to have increased 13 per cent in 1929 as compared with an increase of 8.2 per cent in 1928. The consumption of industrial plants increased 58 per cent during the past five years, from 105,000,000 in 1924 to 166,000,000 thousand cubic feet in 1929. The average yearly increase was 9.7 per cent.

Electric heat in industry continues to expand rapidly, and as in the case of manufactured gas, a large part of the growth is in the heat-treating operations. The consumption of electricity for industrial heating is estimated to have increased 16 per cent in 1929 as compared with an increase of 15.1 per cent in 1928. The use of electric heat in industry increased 139 per cent during the past five years, from 2,380,000,000 kwhr. in 1924 to 5,700,000,000 kwhr. in 1929. The average yearly increase was 19 per cent.

Industry expended over $200,000,000 for the refined sources of heat, gas and electricity, in 1929, $130,000,000 for gas and $70,000,000 for electric heat. This large expenditure in refined heat is resulting from the increasing realization that the B.t.u. method of determination of heating cost is erroneous.

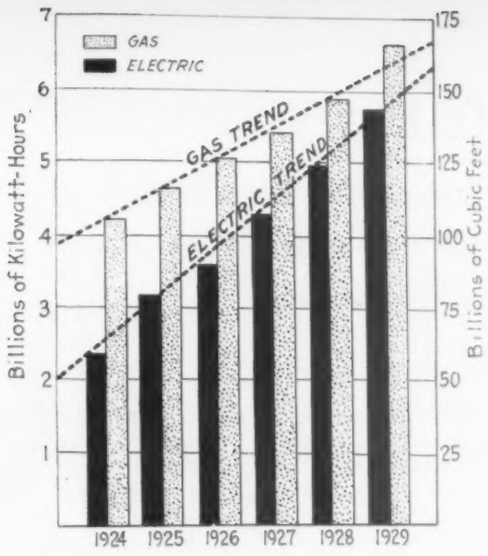
Heat-treating operations are being studied carefully in all parts of the country, not only from the viewpoint of individual process economy, but to determine the overall cost of the product with the different sources of heat. It is being found that profit or loss results from overall cost and not necessarily from individual process cost, and that the heat best suited to one heat-treating operation may not fit another.

Oil Is Replacing Coal

Hand in hand with the extending use of gas and electricity for heat treating in the finishing stages of manufacture, oil has progressed rapidly in the earlier stages and on heavy work, replacing coal. Any drop in oil consumption for the heat-treating processes in the later stages of manufacturing is undoubtedly made up by its increasing use as a substitute for coal. In the oil furnace as well as in the gas furnace, the experience and knowledge gained from the use of heat-resisting alloys and insulation by the electric furnace manufacturer have resulted in marked improvements in construction and process methods in the application of oil.

As the selection of the source of heat for the industrial heat treatment of metals is an economic problem, with the final choice decided by the economics of the local situation, as shown by the overall cost of the product for the different forms of heat, general statements that one fuel is cheaper than another for a heat-treatment process are not only misleading but often erroneous. A fuel which might produce the lowest overall cost in one section of the

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Expanding Use of Gas and Electricity for Industrial Heating in the United States

country or in one plant, because of different local conditions in another section or plant, may be the most expensive fuel to use. Cost comparisons in industrial heating should be made only as applying to the specific application and place under consideration.

Two Outstanding Developments Last Year

DURING 1929 there were many new installations of electric, gas and oil furnaces, which indicated advances in engineering and size of operations, but two new applications stand out as a result of intensive metallurgical research: (1) the short cycle anneal of malleable castings in the electric furnace, and (2) the finishing anneal of brass sheets in the gas furnace.

Electricity Shortens Malleable Annealing

For the electric annealing of malleable castings, two processes have been put into commercial operation, that of Hayes and Diederichs, described in THE IRON AGE of June 19, 1924, page 1797, and that of I. R. Valentine. The Valentine process, as described by Mr. Valentine, has been placed in use at the Erie, Pa., plant of the General Electric Co., where practically the whole production is being annealed electrically. The equipment consists of three 325-kw. elevator type furnaces with a capacity of 100 tons of annealed castings per week.

Both the Hayes and Diederichs and the Valentine processes offer great possibilities with the future development which will come with experience, and should result in a considerable reduction in the overall cost of production of malleable castings because malleable iron is not only produced in from 30 to 50 hr., resulting in a large inventory saving, but boxes and packing are eliminated with a considerable labor saving. The power consumption is 350 kw-hr. per ton.

Gas Replaces Wood for Annealing Brass Sheets

In the non-ferrous industry, the most important development of 1929 has been the installation of a large continuous furnace, heated with manufactured gas, for annealing coiled brass sheets, replacing wood on the finishing anneal. This development is the result of several years of research conducted in cooperation with the research committee of the American Gas Association with a view to obtaining a bright anneal. While a bright anneal is not being obtained in the present furnace, the results have been so satisfactory that a new brass rolling mill is being constructed in the Middle West in which 750 B.t.u. mixed gas is used for all annealing operations.

The finish of the brass is superior to the product of the wood muffle, and the heat cost with gas in the first case is only slightly higher than with wood, and lower in the second installation. The use of natural gas in the smelter and rolling mill of the Anaconda Copper Mining Co. began during the year, and it is probable that there will be a gradually increasing tendency to use gas for annealing in the non-ferrous industry.

Trend in 1930

INDICATIONS point to a continuation of the present trend of increasing use of the refined source of heat, electricity, gas and oil in 1930, with possibly a sharp increase in the use of gas in some localities at the expense of oil, because of the piping of natural gas to several large industrial centers. Electricity will hold its present position as its use depends on overall costs almost entirely, and it is seldom competitive on a thermal basis.

Both the electric and gas industries are conducting intensive research on atmospheric control of electric and gas furnaces during heat-treating operations, which may be productive of results during 1930. The scientific application of heat to industry is in its infancy and much progress in the lowering of costs and improvement of products is to be expected within a few years.

Capacities of Steel Foundries of United States and Canada

UNITED STATES Process	Eastern Division		Central Atlantic Division		Mid-West Southern Division		Mid-Continent Division		Pacific Division		Total	
	No.	Monthly Capacity	No.	Monthly Capacity	No.	Monthly Capacity	No.	Monthly Capacity	No.	Monthly Capacity	No.	Monthly Capacity
Electric	20	4,380	26	5,586	48	13,960	17	2,677	23	3,945	134	30,548
Open-hearth	13	18,045	22	24,324	11	45,699	1	5,600	2	1,500	49	95,168
Electric and open-hearth	2	2,377	4	22,233	2	825	..	.....	1	100	9	25,535
Converter	5	1,656	2	532	7	1,020	4	323	1	950	19	4,481
Crucible	5	234	1	15	..	....	1	15	..	....	7	264
Totals	45	26,692	55	52,690	68	61,504	23	8,615	27	6,495	218	155,996
CANADA												
Electric	8	916	..	....	2	335	..	....	3	200	13	1,451
Open-hearth	1	933	..	....	..	....	..	....	..	....	1	933
Electric and open-hearth	1	500	..	....	..	....	..	....	..	....	1	500
Converter	2	165	..	....	1	100	..	....	1	25	4	290
Crucible	..	....	..	....	1	15	..	....	..	....	1	15
Totals	12	2,514	..	....	4	450	..	....	4	225	20	3,189
UNITED STATES AND CANADA	57	29,206	55	52,690	72	61,954	23	8,615	31	6,720	238	159,185

[Figures were compiled by the Steel Founders' Society of America and are net tons.]

Outlook for the Aluminum Industry

Stability of Prices a Feature—Applications Are Broadening —Effect of High-Priced Copper—Poor Merchandising Retards Progress

BY ROBERT J. ANDERSON*

THE outstanding feature of the American aluminum market in the past two years has been the remarkable uniformity of price for primary metal. Thus, domestic pig prices have now remained unchanged for 24 consecutive months, 98-99 per cent aluminum being quoted at 23.9c. a lb. and 99 plus per cent metal at 24.5c. since January, 1928. There were no price changes made by the European Aluminum Cartel in 1929. This is in marked contrast to the wild fluctuations witnessed of late in certain other non-ferrous metals, notably copper and tin, and has afforded no small comfort to consumers.

Outlook This and Last Year Compared

AT the beginning of 1929 the outlook for the aluminum industry was excellent, and predictions made at that time have been fully justified by the year's results. Exceptionally brisk buying was witnessed in the first half of the year, followed by a small seasonal let-down in mid-summer (due to falling off of consumption by the automotive industry), with a notably good movement in the fall months. There has been a general decline in the last two months of the year, and forward bookings for the first quarter of 1930 have been poor.

The statistical position of aluminum at the close of 1929 was not so good as it was in December, 1928. At the end of the latter year, the usual seasonal decline was much less pronounced than is normal. However, consumers generally are carrying extremely low inventories so that the technical situation is sound. My belief is that the outlook must be regarded as satisfactory, although I doubt that the records of 1928 and 1929 will be attained. Trade may be expected to develop rather slowly until February or March next, but I look for a fairly good year on the whole.

Output and Sales in Balance

Many dire predictions have been heard of late years that great overproduction of aluminum would follow as a natural consequence of the numerous enlargements of reduction capacity, with the result that market prices would fall to unprofitable levels. I have deprecated this view in other articles, pointing out that there is neither any over-capacity nor over-production of primary aluminum. Little has been heard about over-production in the past year, although world output has increased from somewhat under 400,000,000 lb. in 1923 to nearly 600,000,000 lb. in 1929.

Shortages of aluminum have been of more frequent occurrence than accumulation of unwieldy stocks during the past 25 years. Aluminum production has always been controlled within sensible limits to meet the demands of the market. Producers have been more concerned with extending capacity with sufficient rapidity to take care of the increasing consumption than they have been with worrying about the likelihood of too much output.

If there should be any great over-production, the remedy lies in the hands of the producers whose profits are sufficiently large at current price levels to warrant considerable reduction in the sales price. With the extensions under construction or planned for increasing present capacity, I look for world output of primary aluminum to be around 1,000,000,000 lb. by 1938.

Poor Merchandising Retards Expansion

One of the chief retarding influences to the more rapid expansion of the aluminum market in earlier years was poor merchandising. Even today, there is lack of cooperation among different units in the industry. However, of recent years, both producers and independent manufacturing units have been giving more attention to the merchandising problem and studying their markets. The primary concern of every unit in the world aluminum industry today should be aggressive merchandising with a view to the maintenance and extension of existing markets and the development of new outlets. With the right selling policy, there need be no fear about overproduction.

In the United States, the development of new products by the Aluminum Co., of America, coupled with energetic selling methods, has opened new markets for aluminum and manufacturers thereof. Abroad, the European Aluminum Cartel has functioned well in the past three years, this combination carrying on active propaganda and assisting consumers in the proper use of the metal.

The policy of the cartel has been to reduce prices with a view to stimulating the market. This policy has been proved sound. At the time of the formation of the cartel in 1926, the price of primary metal was reduced from £118 to £105 per ton; in 1928, another cut to £95 was made. Last year, there was talk of reducing the price another £10 per ton. Although there was demand by the British member to increase the price in 1929 when the copper market was at its height, this was opposed by German interests.

Higher Copper a Factor

A cogent factor bearing on present prospects, as well as on the long-range outlook, is the rapid advance in copper prices. The high price of copper and brass last year had the effect of stimulating interest in aluminum, particularly abroad. German interests took advantage of the situation to open a campaign stressing the advantage of aluminum at the then comparative price levels, and with very favorable results.

While there has evidently been no general trend toward the substitution of aluminum for copper in the United States, very considerable substituting was done by European countries that are producers of aluminum but, at the same time, large importers of copper. This substituting will evidently be largely permanent and have far-reaching effects.

*Vice-president, Fairmont Mfg. Co., Fairmont, W. Va.; consulting engineer.

Steel Corporation Research Program

Fundamental Work on Behavior of Iron at High Temperature Is Supplemented by Work in Research Laboratories and Investigations at Various Steel Plants

BY JOHN JOHNSTON

THE department of research and technology of the United States Steel Corporation was formally initiated in April, 1927, but it was not until about a year later that it was decided to set up a laboratory in temporary quarters in part of the west wing of the office building of the Federal Shipbuilding & Dry Dock Co. at Kearny, N. J., on the Lincoln Highway between Jersey City and Newark. This building is a long brick and concrete structure, about 50 ft. wide, with two stories and a basement, and is well adapted for conversion to use as a laboratory. Nevertheless it was not until about the beginning of 1929 that the installation of the necessary piping and wiring, partitions, desks and hoods had proceeded to the point at which systematic experimental work became practicable.



Dr. John Johnston
Director of Research, United States Steel Corporation, Kearny, N. J.

During the past year we have set up, and now have in working order, experimental units such as would clearly be indispensable equipment—for instance, small electric furnaces of various kinds with the accessory instruments, complete metallographic and X-ray outfits—as well as a small shop with a precision lathe, milling machine, grinding machine and other requisite tools.

Fundamental Investigations at Kearny

It is the intention to carry out at this laboratory only the type of investigation which is rather fundamental and capable of being done with amounts of material measured in grams or pounds; and, as work on a larger scale becomes desirable on a problem, to transfer it to one of the laboratories connected with a steel manufacturing plant, where such larger-scale work can be handled more advantageously from every point of view.

This general program thus contemplates that the unravelling of the fundamental factors be tackled in the central laboratory, and that the reduction of this knowledge to practice be the general field of the metallurgical and research staffs of the several manufacturing companies (though without any implication that these men should not also tackle fundamental questions if they find it desirable to do so); that there should be free interchange of men and views between the various groups; that, in short, the work should be done where, and how, it can be done to the best advantage of the whole Corporation. The success of such a program depends upon a satisfactory degree of cooperation of the several groups; this is already assured.

We were very fortunate in securing as senior members of the staff Dr. R. B. Sosman, for many years with the Geophysical Laboratory of the Carnegie Institution of Washington, and E. C. Bain, recently with the research laboratory of Union Carbide & Carbon Corporation. Dr. Sosman, who is well known for his work on the measurement of high temperatures and on refractory oxides, is paying special attention to this general field. Mr. Bain, widely known as well versed in the science of metals, is looking after all of the metallographic work. In addition there are at present a dozen technically trained men, as well as two mechanics; and an appreciable increase in staff during 1930 is anticipated.

Research Laboratories in Pittsburgh and South Chicago

The investigations under way, however, are of larger scope than the above number of workers might suggest, by reason of the fact that some experimental investigation is going on at many plants of the Corporation and, still more, that there are now three laboratories maintained by subsidiary companies, assigned mainly to research, with further developments along this line in contemplation. These three are: that of the American Sheet & Tin Plate Co. in Pittsburgh, established some 15 years ago, and devoted mainly to problems related to the production and behavior of sheet and tin-plate; that of the National Tube Co., also in Pittsburgh, which in 1928 brought together in a new building its investigations of steel tubes and pipe, and in particular the corrosion of steel pipe under various conditions; and that of the Illinois Steel Co. at the South Chicago works, inaugurated in 1928, which is concerned mainly with problems relating to the production of fine steels.

Beyond this again, there is a considerable volume of investigational work under way by various small groups directly associated with manufacturing plants, and to some extent, in plant laboratories whose main purpose is the routine analytical control of process and testing.

The work at the laboratory at Kearny is under the direct control of the writer, with the assistance of Messrs. Sosman and Bain, and the advice of the research committee of the Corporation. This Committee, which is made up of a member from each steel manufacturing company together with representatives from the Corporation, holds meetings quarterly at which it discusses the technical complexities of the steel industry and the directions in which research work appears to be most immediately needed.

It is clear that research work can hardly hope to pro-

duce any material reduction in the cost of making steel ingots, in view of the present cheapness of steel and of the fact that an appreciable fraction of its cost is for the raw materials delivered at the plant; and therefore that it should aim primarily to improve the general quality—and perhaps particularly the *uniformity* of quality—of steel and steel products, and to develop the steel best fitted for each particular purpose. This is more easily said than done because, if for no other reason, there is no entirely satisfactory criterion of quality except possibly some test made on the final product; but by the time the final product can be tested it is difficult to determine in which of the many operations between ore and finished article occurred the conditions which resulted in incompletely satisfactory quality.

It is generally agreed that temperature is one of the variable conditions which is not now always controlled as closely as it should be for the best results, and that where this control is as yet less effective—as for instance in the open-hearth furnace—the necessary improvement in control can probably not be realized until temperature measuring instruments are developed which will yield an objective temperature reading of the material itself; to this question we are devoting a great deal of attention. Moreover it is hard to analyze successfully any process, the operation of which is affected by variations in temperature, until one has an objective measure of that temperature as read by a proper instrument; for otherwise one must trust to impressions and opinions which cannot easily be compared and evaluated. Indeed this is merely part of a development already well under way in the steel industry, namely, the substitution of meters and automatic controls in place of the individual judgment and control of workmen—a development which may do for steel what it has done for the chemical industry.

The outstanding difficulty in inaugurating a program of research in the steel industry is to discover just where to begin. There is no lack of problems—very much the contrary; but there is a great lack of precise knowledge of the factors which, by their variability, constitute these problems. This goes back to the fact that the fundamental chemistry of the element iron and its compounds is in many respects much less well established than is commonly thought; this is illustrated by the delay in the appearance of the volume on iron in the several encyclopaedic hand-books of chemistry. Anyone who endeavors to write a critical review of any aspect of the chemistry of iron will be struck by the inconsistent and irreconcilable statements in the literature of the subject and by the lack of definite information on crucial questions; this in turn is due to the reluctance of chemists and physicists to tackle systematically the complexities in the behavior of iron and its compounds.

The elucidation of these complexities will be a long job, but it is going forward in various countries and under various auspices at an increasing rate, in part owing to the increased recognition of the desirability and economy of cooperative work in this general direction.

Good Business Expected, Especially in Standard Machine Tools

An Interview with Ralph E. Flanders

ON being asked to give his appraisal of the present situation in the machine tool industry, Ralph E. Flanders, manager, Jones & Lamson Machine Co., Springfield, Vt., said that 1929 would show that most established firms had equalled or even exceeded the gross sales of the war years. Profits will usually be correspondingly satisfactory, he added, though engineering and selling expenses have increased at a rapid rate.

He said there will be still keener competition in the field of machines for high production rates, not only in the more conventional machines, but particularly in special equipment. "This will lead," he continued, "to increasing engineering costs and some increasing prices. The increased prices will be fully warranted by an accompanying increase in production in the user's shops."

Export trade, he admitted, would be adversely affected by the situation to a certain extent. The machines would be interesting only to customers with high production shops. "Continually improved design and workmanship of foreign-built standard tools will also limit our market in these lines. The year 1930 should display more definite signs of the future of European industry—whether or not it is to tend toward the high production policy. A tendency in this direction would favor our export market."

The recent break in the stock market, he pointed out in the interview, was actually preceded by a drop in machine tool orders. "This recession still continues. There appears to be in general a larger falling off in orders for high production machinery than in standard tools, reflecting the uncertainty of mass production lines. It is worthy of note that a few builders of high-grade standard tools have felt only a moderate drop in business.

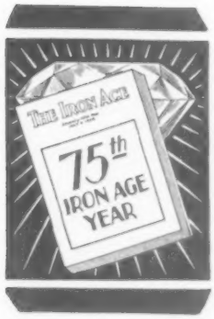
"It appears to me that all the signposts which pointed the way from a stock market crash to a severe business depression have been overturned, and we are mercifully confident of missing this unpleasant but well-travelled road. Agriculture and industry are both in a fundamentally sound condition. That is the best augury for 1930. It will be a good year—not up to 1929, but perhaps equal to 1928."

In respect to the new tungsten-carbide cutting tools, he does not look for radical changes in design of standard machines. Increased use of such cutting tools will call for higher speeds, and there will doubtless be some further extension of hydraulic operation. "But in my opinion 1930 will call for a slightly larger percentage of standard tools as compared with special and high production machinery, which latter, naturally, would be more likely to attempt to get the full benefit of the improved cutting tools."

Corrosion of Aluminum-Silicon Alloys

In a second note on the corrosion of aluminum alloys presented Oct. 14 to the Académie des Sciences (Paris), Léon Guillet and M. Ballay described the action of superheated steam on these alloys. The temperature of the steam varied between 300 and 350 deg. C., and the steam was blowing on the test pieces nine hours a day for 34 days. Aluminum of 99.87 per cent purity was found to be by far the most severely attacked, the metal being entirely destroyed when in a direct current of the steam. When in a steam atmosphere the destruction was only a little slower.

Impurities such as iron and silicon, which usually encourage corrosion in water solutions, noticeably retarded destruction in superheated steam. An alloy containing 13.08 per cent of silicon and 0.63 per cent of iron showed the greatest resistance, corrosion being visible only with a microscope. Generally the rate of corrosion decreased as the proportion of silicon was raised.



Management

A commentator on business administration writing in 1915 would have dwelt much upon scientific management, that term then regarded as embracing such things as time study, expense burden, and the economics of mass production. Writers of the reviews appearing in this number of THE IRON AGE, tacitly or explicitly accept the proposition that these problems have been solved reasonably well, but point out that the same principles which have helped to drive down production costs must now be applied to the problem of marketing. Unless this is done promptly the cycle of declining prices and increasing distribution expense will extinguish all profits.

It is also clearly indicated that a disturbing factor in the problem of marketing is the increasing amount of unemployment. Obviously a steady wage earner is the only good cash customer. Yet since 1920 the ranks of the unemployed have been augmented by 650,000 elderly workers, a state of affairs which warrants close study on more than humanitarian grounds.

Management executives have also before them the problems of waste elimination and obsolescence, in which 1930 should see much progress.

More Concern About the Jobless

Problem Created by Idle Workers Leads to Stabilization Programs, Five-Day Week, Census of Unemployed and Growing Interest in Unemployment Insurance

BY GLENN A. BOWERS

STANDING at the bend in the road, we may look back upon 1929 or forward into 1930 and observe in the United States a period of unprecedented concern over employment and unemployment problems. Periodic industrial crises for a century or more have caused temporary unemployment, but virtually at no time prior to the present decade has sufficient unemployment prevailed during industrial activity to attract attention. The normal body of unemployed while industry is active has, however, always been substantial, consisting of those who are changing jobs and others who "have a quarter and don't feel the need for another one." It has been estimated that there are roughly 2,000,000 such unemployed persons normally.



Glenn A. Bowers
Director of Research, Industrial Relations Counselors, Inc., New York

But the old order has apparently changed, at least for a time. The deflation of labor supply at the close of the war was the natural result of large numbers of women and others not normally workers coming into industry during the war period. This process was virtually completed with the depression of 1921.

The striking fact is that the number of industrial workers has been further reduced since 1923 by perhaps 2,000,000. This story, involving also the transfer of industrial workers to service jobs, the curtailment of immigration and the shift of population from farms to cities, as well as other related situations, is now well known. It has been effectively told in "Recent Economic Changes," published this year by the National Bureau of Economic Research for the committee appointed by President Hoover under the President's Unemployment Conference.

This background of post-war industrial change, about which volumes have now been written and hundreds of articles prepared for periodicals, has served as the stage for employment in 1929 and 1930.

Even after the final figures are available, it will probably still be true that the calendar year just closed was the biggest from the standpoint of industrial activity that this country ever witnessed. Although the general index of employment in November, and probably December (reports not available until the middle of January), was lower than for the corresponding months of 1928, all other months of the year showed an increase over the same months of the previous year.

This turn of the tide was not uniform throughout all industry. The machine tool, electrical, shipbuilding and petroleum industries continued to show increases in employment, while automobiles, tires, iron and steel, and building showed declines. For "iron and steel and their products," considered as a group, the employment index showed a slight increase in November over the same month in 1928, but was lower than in any month since last January. Payrolls for November were lower, however, than for any month since October, 1928. The structural iron work branch of the industry was much more active in the latter half of 1929 than during the first six months.

Preparations for Industrial Recession

LONG before the peak of industrial activity was reached, preparations were under way for the period of recession when it might come. Stabilization programs were planned by many companies, district conferences were held in New England, Pennsylvania, and on the Pacific Coast in endeavors to forestall violent fluctuations in employment; and national studies and programs emanated from Washington.

For more than a year a committee of the Philadelphia Chamber of Commerce under the chairmanship of Morris E. Leeds, Leeds & Northrup, has been studying the problems of unemployment and of regularization of employment. In this community effort the Board of Education, the Federal Reserve Board and the Department of Industrial Research of the Wharton School, University of Pennsylvania, have been cooperating. A progress report issued in September set forth the goal to be approached by Philadelphia business men and by American industry, namely, "that every person who is honestly seeking should be able to find work that is suited to his capacities, under conditions that are reasonable; and that when he has to change from one job to another, it should be possible for him to do so without reducing himself and his family to living conditions that will deteriorate them." One outgrowth of the Philadelphia movement is the project for the establishment of an Institute for the Regularization of Employment at Swarthmore College.

Unemployment has been a factor in the spread of the five-day week in the building industry. In the New York building trades agreement this was a factor, although perhaps not the most important one. The recent action of the Builders' Exchange of San Francisco in announcing that effective Jan. 1, 1930, the building industry of that city would work on a five-day schedule was based frankly on the existence of unemployment.

Public Employment Services Inadequate

WHENEVER and wherever unemployment has been a problem, one of the essential points of attack has been through the public employment offices. Since the Armistice the Federal Employment Service has dwindled

until it is little more than a paper organization. Several States operate employment services. On the whole these are inadequately financed, poorly equipped with low-salaried personnel and generally inefficiently administered. Employers frequently prefer to use the more alert and better managed private offices, even though fees are involved. Politics and union control of public offices are not unusual charges. On the other hand, many trade association and trade union employment bureaus serve selected industries.

During the year an effort was made by those interested in public bureaus to effect a reorganization of this service. In New York, Frances Perkins, newly appointed Commissioner of Labor, has created a survey committee which is now studying the administration and methods of the public employment bureaus of the State. Illinois and Wisconsin have similar rehabilitation programs. If these State services can demonstrate that public employment offices can be operated effectively, the groundwork for a national system might be laid, and it is not inconceivable that definite steps may be taken in that direction within a very few years. Should this take place, the private or fee-charging agencies may remain in competition with the public offices on basis of special or better personal service rendered.

Index Numbers of Employment and Payrolls—Iron and Steel and Their Products*

	1928		1929										
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Employment:													
Total industry	94.8	95.0	94.8	97.2	99.2	100.4	101.5	101.7	101.1	100.4	100.7	99.5	96.6
Iron and steel	93.1	92.8	93.4	94.0	95.0	95.9	97.1	97.2	96.6	97.5	96.3	93.9	92.3
Cast iron pipe	75.9	74.2	73.3	69.1	73.4	74.5	76.0	78.6	80.4	81.7	81.8	79.4	74.1
Structural iron work	98.5	101.2	97.7	97.6	98.1	98.7	100.4	102.3	104.3	106.8	107.7	106.9	103.8
Foundry and machine shop products	95.6	96.3	97.6	101.3	104.4	106.8	108.3	108.6	108.4	105.3	105.7	104.7	101.2
Hardware	91.5	92.2	92.2	94.8	95.3	92.9	93.4	92.8	91.6	89.4	92.2	92.0	88.8
Machine tools	114.2	118.2	120.1	124.3	129.0	129.7	130.3	132.3	133.2	131.2	134.9	135.8	132.0
Steam fittings	79.4	72.8	81.2	84.3	82.6	81.4	78.2	76.6	72.8	76.6	77.2	79.1	78.5
Stoves	95.2	91.3	81.1	88.4	90.6	92.4	92.9	92.2	85.7	91.5	97.1	100.2	92.6
Payrolls:													
Total industry	97.7	98.0	95.5	102.5	105.2	107.4	108.4	106.8	101.9	104.5	104.2	104.4	97.2
Iron and steel	97.6	95.8	95.5	100.2	102.2	104.8	105.9	104.0	97.6	103.4	101.7	91.1	92.3
Cast iron pipe	73.5	94.8	67.0	70.3	69.9	73.7	75.0	78.3	81.8	83.3	83.3	80.3	72.7
Structural iron work	104.3	104.9	96.3	99.2	99.3	101.6	103.6	104.7	104.3	110.5	112.1	113.1	105.4
Foundry and machine shop products	96.8	99.8	97.7	106.7	111.0	114.1	115.4	113.5	109.7	109.9	108.1	109.5	102.5
Hardware	94.3	95.8	93.0	99.1	98.4	95.6	97.1	95.9	89.6	90.9	93.4	94.2	88.8
Machine tools	125.6	132.8	129.1	138.0	142.3	144.0	143.1	144.1	140.4	137.6	143.9	146.5	137.4
Steam fittings	78.1	72.2	78.4	88.0	85.7	82.8	79.6	76.4	70.8	76.2	78.2	82.8	76.5
Stoves	94.2	89.0	73.8	85.2	87.3	89.7	91.1	89.0	80.3	85.8	93.4	102.3	87.4

*Monthly average for 1926. Source: United States Bureau of Labor Statistics.

Insurance and Public Works in Relation to Unemployment

UNEMPLOYMENT compensation has not been attempted to any great extent in the United States. A few companies and several trade unions, however, have done noteworthy pioneer work, and some of the more effective plans tried have been jointly managed. The voluntary, semi-compulsory and compulsory schemes of unemployment insurance in the industrial countries of Europe have been developed out of historic situations vastly different from those of our own country. This fact, however, does not render invalid the possible lessons that the experience of these older industrial countries holds for the United States if and when the unemployment situation becomes critical. A comprehensive study of international experience with unemployment insurance, now nearing completion, is being made by Dr. Bryce M. Stewart, Mary Gilson and several associates in the Industrial Relations Counselors, Inc. The countries covered include England, Germany, Belgium, Holland, Denmark, Switzerland, France, Italy and Poland.

By far the most active and effective agency in the United States in dealing with the unemployment problem is the President's Conference on Unemployment. Originally created when Mr. Hoover was Secretary of Commerce as a remedial body to deal with the emergency situation of 1921, it has been continued as an instrument for research and planning to offset the possibilities of similar situations in the future. The first of the surveys was the study of "Business Cycles and Unemployment" made in 1922-23 for a committee on this subject by the National Bureau of Economic Research. The second was a study of "Seasonal Operation in the Construction Industries," made in 1923-24, and the third, "Recent Economic Changes," to which previous reference has been made. These three projects were set up "to enlarge the general understanding of our economic system and to stimulate the continuing reduction of unemployment." Another important unit in this series is a report, which is nearing completion, on public works as a means of regularizing employment. This volume, "Stabilization Through Public Construction," by Dr. Leo Wolman, will be published by National Bureau of Economic Research.

First Census of Unemployed

BUT as yet little is known of the extent or location of unemployment. In fact, not until the fifteenth census data are tabulated and analyzed in 1932 will there be reliable statistics available. The census to be taken in 1930 will be the first to contain a schedule on unemployment.† In preparing the schedule the Committee on Government Statistics of the American Statistical Association did important advisory work. This same committee prepared during the year a report on employment indexes in the United States and Canada which lists the agencies which collect and publish employment data.

The series of movements, researches and programs mentioned in this brief review are ample evidence that the subject of unemployment presents issues of unusual moment and of national consequence. Instead of the traditional condition of a relatively small margin of unemployed persons, apparently there are sizable groups which have been displaced in recent years for one reason or another. Technical improvements, new mechanical equipment and shorter processes have brought their toll of unemployed, although there must be a great deal of truth in the idea that new industries absorb many of those who lose their jobs for these reasons.

More Unemployed Than Year Ago

ONE might think from the foregoing sketch and from a collection of the recent stock market crisis that 1930 is a good year for workers to hold on to jobs they now have. And so it may be, but if we are to place any weight upon the forecasts of business leaders in key industries.

†Although unemployment has been recorded in some previous censuses, it has never been tabulated for publication.

the prospects are by no means depressing. Industry after industry has promised President Hoover that it will undertake improvements and extension of plants and structures. Others have planned to spread the work among present employees rather than to make substantial lay-offs.

To attempt a forecast of employment conditions in specific industries for the year ahead would take us far afield into other items of business analysis. Suffice it to say, for the situation as a whole, if some indication of the future there must be, that the new year does not start as favorably as did 1929 and that the present condition may even grow worse before the seasonal increases of the summer arrive to pick up the slack in employment. Certainly in no other period has a greater concentration of brains been focused in advance on the problems which prevail during the valleys of business cycles than has been brought together by President Hoover to map out a schedule of work.

Many Industrial Wastes Uneliminated

Numerous Leaks in Production and Distribution Remain Unstopped, Awaiting the Attention of Management

BY HAROLD V. COES

IN considering the paths that American industry can safely pursue in the further elimination of wastes, a broad picture can best be obtained by research in the four essential phases of business:

1. DISTRIBUTION RESEARCH—A survey and study of markets, more effective and less wasteful methods of distribution, careful appraisement of the functions of distribution and the agencies, machinery and mechanism for performing them.
2. MERCHANDISE RESEARCH—Ways and means for the development of more attractive and profitable products, giving careful consideration to design, preparation, quality, color, style and service.
3. INDUSTRIAL RESEARCH—Studies and surveys to appraise present methods, functions, agencies and means and the determination of new and more economical manufacturing and processing methods and equipment.
4. MANAGEMENT RESEARCH—Studies to appraise present functions, agencies, methods and means in order to simplify and perfect organization and control, to discover and apply economical methods of administration.

Progress is being made in distribution and marketing research, and this work is doing for distribution just what similar research did for production. There has been built up in the past 20 years, and more specifically in the past 10 years, a technique of production and a science of production management.

This technique was built up by painstaking attention to details and upon thousands of tests and experiments until finally we have begun to reach the ultimate of refinement and more nearly to approach the status of exact science in applying mathematics to the fundamental economics involved in production, thereby resulting in the elimination of considerable wastes.

Simplification and standardization can be carried into more industries and embrace more articles than at present. There seems to be some confusion in the minds of manufacturers as to the essential difference between simplification and standardization and initiative in design. Just because a group of articles in a given industry has been reduced from 20 recognized lines to four or five lines it does not necessarily mean that the individual manufacturer is hampered in any way as to his ingenuity and initiative in design, or in his choice as to style, color, quality and preparation with respect to lines that have been smiplified and standardized.

Standardization may not necessarily come with simplification, yet it is its handmaiden; and, conversely, simplification can take place without extended or detailed standardization. If the two principles are, however, applied intelligently, there is abundant evidence and experience to show that considerable waste can be eliminated.

Budgetary procedure and regulation, experience shows, is an excellent discoverer of existing sources of waste, and in thinking through the budget and the detailed studies of a business that must necessarily follow before real budgetary practice can be installed, ways and

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IN a letter discussing the article he prepared the author said: "I came to the conclusion that your readers would best be served if I painted a broad picture and did not becloud or distort or detract from it by the over-emphasis of too many details.

"If American industry can get the picture that there are existing wastes in practically every phase of their activities, many of which can be completely eliminated and many of which can be reduced, regulated and controlled, and if they will cease to bring undue emphasis on the inefficiency of one and completely overlook others more insidious and even of greater proportions, though hidden, we will have gone far in the elimination of wastes."

Mr. Coes is manager, industrial department, Ford, Bacon & Davis, Inc., New York.



means are discovered and devised for the control, regulation and elimination of many of these sources of discovered wastes.

There are sources of wastes in administration, materials, labor employment and turnover, overhead and experimental work, in design, blueprints and records, in plant, in the equipment, in machinery and process layouts, in the machinery, tools, jigs, fixtures, in maintenance and repairs, in the layout and routing of production operations, in rates and compensation, in stock tracing and stock records, in purchasing, in receiving, checking and inspection, in material handling, in department management, in inspection, in preparation, packing, warehousing, in distribution, marketing, selling, advertising, shipping, servicing, spoilage and damage, accounting and records, forms, financing, etc.

F. W. Shibley in his recent book, "New Way to Net Profits," makes a statement which to my mind succintly sums up the ultimate aim for the elimination of wastes in production and distribution:

"The day is coming when the production and distribution of merchandise will be established upon an economic basis as to both cost and sales price in a manner similar to the control systems governing the railway and other public service enterprises."

But he goes on to say:

"But that day seems far away and the problems of the present demand speedy solution for the sufficient reason that each year apparently profits are growing less. The answer lies in a coordination of all the elements entering into distribution exactly as they have been coordinated in successful production."

Lightning Changes in Vocations

Displacements Caused by Mechanization Not Wholly Absorbed by Merchandising and Service Occupation

BY HARRY W. LAIDLER, PH.D.



EVER since the beginning of the industrial revolution, shifts in industry resulting from mechanical inventions, changes in style and industrial consolidations have been the order of the day. These shifts have usually meant in the long run greater productivity and a higher standard of living. Immediately they have brought in their wake much suffering to a large proportion of the individuals compelled to change their occupations.

In the United States these economic changes have been particularly marked since the World War. In agriculture, according to the National Bureau of Economic Research, the net exodus from the farm to the city from 1920 to 1927 was more than 3,000,000. In manufacture, the list of wage-earners, according to Doctors Wolman and King of the National Bureau, diminished from 1920 to 1927 from 9,735,000 to 9,100,000, a shrinkage of 600,000 (*Recent Economic Trends*, p. 478). In steam railroads there was also a considerable decrease (from 2,163,000 to 1,856,000). In the express companies, the numbers fell from 91,000 to 65,000; in water transportation, from 399,000 to 341,000. In the coal mining industry the numbers employed dwindled by about 100,000. This was also accompanied by a decrease in the number of days worked each year.

This decrease in wage-earners employed was not, of course, characteristic of all phases of manufacturing, transportation and mining. The last decade or so has seen great advances in the radio industry, in the automobile industry, in the manufacture of electrical appliances, etc. While the woolen and cotton industries have been in the doldrums, the rayon industry has leapt forward in startling fashion.

While those applying for jobs on the steam railroads found their way blocked by "No Help Wanted" signs, an increasing demand for workers has been in evidence in bus and truck transportation. In fact, while 750,000 were employed in this phase of transportation in 1920, this number by 1927 had more than doubled.

Shifts to Merchandising and Service Occupations

The chief shifts of the decade, however, were away from manufacturing, transportation and mining, etc., in the direction of merchandising and various non-industrial occupations. The number of workers engaged in the merchandising of commodities increased from 1920 to 1927 from 3,215,000 to 4,633,000, an increase of nearly one and a half million. The professional and allied occupations grew in numbers from 1,396,000 to 1,987,000; the financial groups—banking and insurance agents—from 352,000 to 507,000; and the miscellaneous groups—waiters, barbers, moving picture operators, garage employees, cosmetic artists, etc., from 2,019,000 to 3,353,000 or a total increase for these various vocations of nearly two and a half million. Yet despite this augmentation of various branches of industry and the professions, and the fact that the expansion of miscellaneous and mercantile occupations made places for perhaps four and a half million new wage-earners—there has been a net increase in *unemployment*, according to the Bureau, of 650,000 people.

Output Per Worker Up 35 Per Cent in 5 Years

The causes of these shifts? They are various. They include the rapid application of machinery and other labor-saving devices to industry. As a result of this development, from 1899 to 1925 the product per capita on the farms, in the factories, in the mines and on railroads increased by 60 per cent since the final years of the nineteenth century, and the volume of output per worker, some 76.6 per cent. *In manufacturing alone the output per worker increased from* 1921 *to* 1925, *it is estimated, by no less than* 35 *per cent.* In the iron and steel industry this increase for the six-year period 1919 to 1925 was 37.6 per cent. As a result of these changes our industries can now produce all that is necesary to provide for the health and comfort of the American people. The great question remaining for solution is the question of distribution.

Occupational shifts have been stimulated not only by increased productivity in already established industries, but by revolutionary changes in the tastes of consumers. Many of these changes in tastes have, it is true, been encouraged by producers of particular commodities, but have also had their origin in consumer demands resulting from the general educational process and from changes in financial status.

Shifts in the geographical locations of industries—the removal of textiles from the North to the South, of the shoe industry from New England to the Middle West, etc.—have likewise played their part in the flow of labor to diverse occupations. Where an industry has invaded a new territory, the workers in that territory have been compelled to readjust their life to an entirely new economic environment. Finally, the merger movement which has advanced with such rapidity since the World War, has played its part in occupational changes.

In the old days of agriculture and of the handicraft industries, man was usually wedded to his job for life. Today, multitudes are compelled almost over night to lift themselves from their economic moorings and to travel to unknown seas. The risks which these swift changes impose upon the individual are out of all proportion to his ability to carry them. These risks have lately been greatly increased by the policy adopted by many corporations of refusing to take on new workers after they have reached the age of 40, 45 or 50 years. This increasing insecurity calls for some form of social insurance against unemployment, against sickness, accident and old age. Otherwise these industrial dislocations will continue to carry in their wake bitter suffering—temporary or permanent—to millions of honest, conscientious members of the laboring masses. Under these conditions, a good American life is impossible. The situation calls for careful thought and courageous action.

Money Rates Forecast Upturn in Production by Middle of 1930

RECENT events have clearly demonstrated the forecast value of money rates and have shattered the belief that the stock market discounts major fluctuations of business, according to Alvan T. Simonds, president, Simonds Saw & Steel Co., in the January issue of *Looking Ahead*. The present trend of money rates, in his view, portends another major upswing of industrial production by the middle or shortly after the middle of 1930.

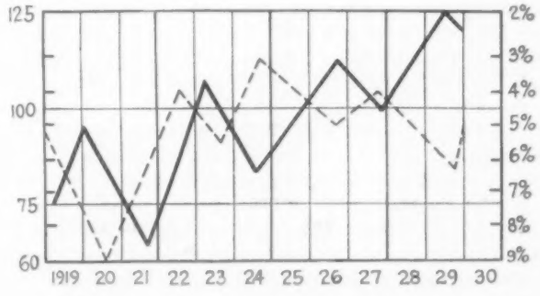
The chart shows that "each major movement of industrial production is preceded and forecast by a corresponding movement of money rates." The present downward movement of industrial production has been forecast since Jan. 1, 1928, Mr. Simonds asserts. The next major upswing of industrial output is now being foreshadowed by declining money rates, rates having fallen in the short time since Nov. 1 from 6¼ to 5 per cent. The usual seasonal swing from January to April is likely to occur, he says, but it will be a minor movement and will fall short of the peak in 1929.

"Just now, because money rates are falling, practically everybody is convinced that this will be followed before long by increased business, by an upward movement in industrial production. It is almost unbelievable now that when commercial money rates were so rapidly rising in 1928 and the first half of 1929, practically no one was convinced, or could be, or would be convinced that such a rise would be shortly followed by a decline in industrial production and in general business. As a matter of fact, the downturn in business came about 18 months after the upturn in money rates.

"When the stock market smash came in the last week of October, 1929, President Hoover with his usual good sense and foresight realized at once that something must be done to avert serious depression, that something must be done to brace up weak knees, to change the psychology of the great mass of people in the United States from a psychology of despair to a psychology of hope.

"If we remember rightly, both Mr. Hoover, then Secretary of Commerce, and Mr. Mellon gave warning in the spring of 1923 that some lines were overproducing and that there was danger of a repetition of the experience of 1920-1921. This warning was followed almost at once by a decline in business activity—the recession of 1924.

"President Hoover's plan for leveling the road of business was announced in a report of the Conference on Unemployment in 1921. In short, it is to fill up the valley ahead by taking off the hill which comes before the valley. This to be effective, of course, should be done before business gets down into the valley. This was not the case in 1929. Business is now slowly going down into the valley, but the profits made at the peak of 1929 are still available to help fill up the valley which seems to be ahead. Therefore, President Hoover would have business corporations spend now all the money they can spend wisely or that they will need to spend in the near future and which they can just as well spend now. He would have the Federal Government and the State, city and town governments spend now all the money that they have available or that they can raise for improvements that are needed and that they can afford to make now.



SOLID Line Represents Major Movements of Industrial Production (Daily Average Production for 1923, 1924 and 1925 Equals 100). Dotted line represents major movements of commercial paper rates in New York

"Several traditional beliefs have been shattered by the speculative smash. Among these is the belief that the stock market discounts by some months the major fluctuations of business because the consensus of buyers in the stock market is a consensus of the best business and economic minds in the nation. Contrary to this belief, five million speculators could be and were wrong. Stock market prices in July, August and September, 1929, were not a safe guide to the course of business in the fall of 1929. Stock prices did not turn down in a major movement until after business had turned down in a major movement in June, 1929. It is safe now to believe that stock prices will not turn up in the next major movement until after business has turned up in its next major movement.

"Now is the time for optimism, not for excessive caution. Caution was what we needed in the first half of 1929 instead of excessive optimism."

Trends in Market Management

Studies of Consumer Needs Must Now Be Made a Major Job and Be Given Scientific Handling

BY W. E. FREELAND*



W. E. Freeland

THE relatively simple mechanisms of selling of former days are rapidly disappearing. The vocabulary of the marketing manager today includes such terms as market evaluations, forecasting, budgeting, research, consumer reactions, merchandising, incentives, contests, dealer service, inventory control, duplication of circulations, trading areas, and particularly such terms as plans, controls and standards. He is reading books on economics, statistics and psychology.

The swift tempo of current events has forced new habits of thought as well as an expanded vocabulary. The new needs have brought a different type of man to head the marketing organization.

In the old days a sale of consumer goods was considered completed when an order had been received, the goods shipped and invoiced and a check received from the customer. Today there is a growing appreciation that no sale is complete until the goods pass out of trade into consumption. The manufacturer has been taught that he must help to move the goods out of a dealer's stock and hence we find, in many cases, extensive plans and heavy expense budgets for assistance at the point of actual sale.

So, too, makers of raw materials and producers' goods are spending large sums on research and service to further the interests of their customers. Intelligent management has provided these newer services because it has learned the low cost of repeat orders and the value of continued friendly relations generated by the goodwill resulting from a program which reaches further than mere order taking.

Forces Changing Marketing Methods

ONE of the economic forces tending to change marketing methods rapidly is the quick growth of our industrial facilities and the sharp increase in production per man-hour through better equipment and methods. Almost over night after the late war we found that we had passed from a seller's to a buyer's market.

The efforts of the companies weak in financial and management strength to survive have produced—and continue to produce—a chaotic competition. The cure is largely but slowly being found through liquidations and mergers. The fact that mergers or other forms of group operation are the order of the day has affected marketing greatly. Many a manufacturer today is getting a large portion of his sales volume, not through a flock of order takers roaming from town to town, but through a meeting of executive with executive where skilled negotiation and frank discussion of mutual needs and conditions produces orders in volumes undreamed of in the older days at very low sales cost.

Another new force is the recognition that the consumer is the one who really dictates what the manufacturer shall make and what price he shall get if the manufacturer is to be successful. So today the modern tool of market and consumer research is turned upon the consumer and an earnest effort made to gain knowledge of his habits, instincts, reactions and inhibitions.

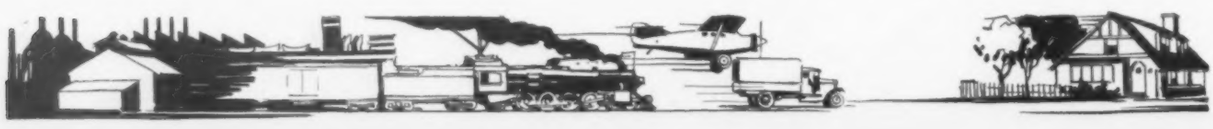
It has been proved that it is not enough to sell him merely a product; it is equally essential that with that product shall go satisfaction of an expressed or dormant need. Consumer research will disclose the artisan's resistance to parkerized instead of polished wood chisels. So will consumer research find the "plus" of satisfaction which will lift a product out of the rut of price competition, whether it be the insulation of a gas range or the chromium plating of the hardware on his car.

In the old days the custom was to keep a flow of ideas from manufacturer to consumer, fostered particularly by the ever-alert advertising profession. Rightly handled, the profit from this activity has been proved. Today, however, there is beginning to be stressed the profit which comes from the steady flow of ideas from consumer to manufacturer.

Another force steadily at work arises from our position in a cycle of declining prices. This force appears in the increasing difficulty of maintaining profits. In most industries the management sees a steadily rising cost of marketing and is disturbed thereby. The manager naturally attacks this rising cost and pressure upon the marketing manager for more efficiency increases. If there is no research organization it is usually difficult for him to prove, as may well be the case, that there is something wrong with product design or quality or with one or more of the elements of production which create costs and prices which set up market resistances that directly influence marketing costs.

These contributory elements of marketing cost do not remove the current charge against marketing management that it has done little in analyzing and controlling

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the costs of marketing and but little more in adopting the practices of scientific management developed in the field of production.

Current Problems of Marketing

IN this country we have built up an ideal of bigness. Many a small manufacturer is looking forward to a goal of national distribution. He has given little study to the fact that industry has been spreading throughout the land and that buying habits of his customers have changed to a point where quick service from a nearby point may outweigh lower price from a distant point. Neither has he dug deeply into the true cost of what we are beginning to call "marginal sales"—that volume of sales which can be obtained only at a cost higher than normal. Even when he has been somewhat aware of it, he has excused it on the ground that the economies of increased production would compensate for it. Our increasing skill in cost accounting is disclosing that blind belief in undisclosed production economies underlies many a poor earnings statement.

One of the jobs of the marketing manager is to weigh the profit in working a restricted market intensively as against the profit of working an extensive, broader market with thinner and more superficial sales effort. The decision seems to be increasingly in favor of a more intensive effort in a smaller area, or in a less number of possible industrial markets.

What Number of Local Distributers?

Where a manufacturer makes goods for resale we find a live topic for discussion in the value of selective distribution. Shall he have one distributer in the small city or shall he try to sell every possible sales outlet in that city? Of course, there can be no standard answer. Where the product is a specialty and requires sales effort on the part of the dealer and a considerable investment in order to have an adequate service inventory, the trend is toward selective distribution. One retailer, who makes the product a leader and gets back of its sale, may be much more valuable than a number of retailers who stock only a portion of a manufacturer's line and wait for him to do all the work of creating an active demand for it.

Another problem of many manufacturers lies in the value in using "missionary" or "specialty" salesmen to work among retailers in behalf of his jobber distributers. Is this a growing evil or a stern necessity? Many a manufacturer would like a decisive answer to that question. Where the profit margin is large the problem is not so acute but the practice is spreading down to lines with close profit margins. It is, perhaps, often due to the intensive competition of a lot of competing brands to occupy a place in the sun.

The manufacturer wants to know why he should continue to give the jobber the same old discount if he must do so much of the jobbers' sales work. Where he has not found an answer he has often turned to direct selling and dropped the jobber as a distributer. The disconcerting thing has often been that the jobbing discount has failed to cover his increased marketing costs.

Problems of Chain Store Distribution

Possibly the most disturbing thing has been the growth of chain stores and "voluntary chains." One morning he has 24 distributers in a certain area and the next morning he finds he has only four distributers and must deal with a new, strange group buyer to get distribution through the other 20 stores. A new voluntary chain has come into existence with a definite goal of buying at a lower price.

Whether to sell the chains, as well as how to sell the chains, is an ever present problem of the manufacturer. If he is big enough and his line of products is comprehensive enough, he answers it by establishing his own chain. That, though, is a solution that only a few can apply.

Must Make Merchandising a Major Function

Another current problem of the manufacturer of a varied line of products is the coordination of sales and production. Involved in this problem is sometimes a vexing friction between the two departments. The answer has become definite—it is the recognition of merchandising as a major function of business and the establishment of a merchandising division.

The merchandising division must have a thorough understanding of the needs and capacities of both sales and production and the judgment necessary to weigh these factors and inaugurate programs that will contribute most to profits. Subject to final administrative approval, it assumes responsibility for several important things. It decides the length and character of the line of products, as interpreter of the market initiates new product studies, and controls the inventory of finished goods. It studies and decides price problems. It studies and develops new uses and new markets. It helps to train the sales force and distributers on the sales points of product. It has a special problem of keeping production equipment busy and balanced and of securing properly proportioned distribution in all sales areas and markets. It has been rightly called the profit-making function.

Outlines Selling Problems

WHAT the manufacturer needs to study in meeting the problems of cutting distribution costs include, as discussed in the accompanying article,

methods of learning customers' ideas and situations

* * *

doubtful expediency of marginal sales handling chain store and merger developments

* * *

wisdom of making market surveying a major management function

* * *

putting scientific management ideas into marketing

More Science in Marketing

THE star salesman of a company may not—and generally is not—the right material for marketing manager. The marketing manager is, of course, a major executive but he must be of the analytical, thinking, planning type. He must be interested in facts but have the gift of vision to use facts advantageously.

The scientific approach to the problem of merchandising is to employ the successive steps of research, analysis, classification, measurement and standardization. It is the attempt to use some measure of scientific method

(Concluded on page 76)

Put Profits Into New Equipment

Obsolescence of Machinery Must Be Provided for by Setting Aside Fixed Percentage of Profits

BY W. H. RASTALL*



W. H. Rastall

IN connection with President Hoover's campaign for "Planned Prosperity" emphasis is being placed upon the importance of rehabilitating or replacing depreciated or obsolescent equipment in order that we may be prepared to operate efficiently and profitably when the business cycle again turns upward. It is recognized that activities along this line at the present time are both important and desirable, and that such capital expenditures will tend to prevent the approach of a serious depression.

There is a further angle of the replacement program that is not appreciated and which perhaps can be best illustrated by reference to certain conditions abroad. Japan has a very important textile industry employing perhaps six million spindles and Japanese manufacturers have been successful in competition with British and American textiles in the Chinese market.

There is not a Japanese spinning mill which pursues a policy of a fixed percentage of depreciation, according to reliable British authority. It is the custom in Japan and in China to consider this item *only after* allocation of profits and reserves. Japanese textile mills wrote off for depreciation 15.9 per cent when they paid as dividends 32¼ per cent in 1917 and 14.9 per cent in the following year when dividends were 51.2 per cent. Conservative European or American management would probably not consider these allowances for depreciation too high for even ordinary years when it is remembered that these mills operate perhaps 20 hr. a day and are always subject to earthquake hazards.

Disaster Shows Unsoundness of Policy

The unsoundness of this Japanese policy was demonstrated in 1923, according to the same British authority, when, because of the earthquake, some 328,000 spindles were entirely destroyed and 200,000 more required reconstruction. The value per spindle of equipment bought between 1917 and 1927 averaged perhaps 90 yen, while the book values of spindles bought before 1917 were about 29 yen. Fortuitous circumstances have allowed the Japanese spinning industry to flourish, but it appears to be quite obvious that its accounting methods are open to serious criticism and except for unusually favorable conditions, the Japanese textile industry might now well be in a very serious position.

The British also have their difficulties. For many months the Balfour Committee has been studying the conditions and prospects of British industry in order to discover what might be done to restore healthy business conditions and reduce unemployment. The reports of the committee fill several volumes and emphasize that one of the outstanding difficulties is the obsolescence of British equipment. They have made plain the fact that the reconditioning of British industry will require a great deal of scrapping and replacement of plant.

In many instances British industry finds it difficult to rehabilitate equipment because of the difficulty of finding the necessary capital. The banks and investors in England are prepared to furnish this capital, but are unwilling to do so until shown adequate security and a reasonable prospect of obtaining a satisfactory return.

As the committee stated, "The tap root of the mischief is the continued unprofitableness of so many industrial concerns which makes them unable either to give security to the banks or to offer an attractive investment to the public. We seem here, at first sight, to be faced by a dilemma, for industrial health can only be restored by the aid of fresh capital, and fresh capital can only be attracted by the restoration of healthy conditions. What is the way out of this vicious circle?"

British Industries Failed to Set Up Reserves

In other words, these British industries find their equipment obsolete, yet obviously they have so managed their accounting that in earlier years they did not set up reserves to meet this contingency. The very health of their enterprises is involved. In fact, it would appear that unconsciously the management of those enterprises have liquidated their assets through failure to allow in their prices for depreciation and obsolescence costs, and the plants are no longer as valuable as the original investments made by their stockholders. These unseen factors have destroyed the strength of their business structure, much as white ants invisibly destroy a structure of wood.

Although references have been made to Japan and England, we find that the same errors are made in American industry. All too frequently the allowances for depreciation and obsolescence are inadequate. In some cases reserves for these purposes are set up and then diverted to other uses. In either case, when a situation such as the present one develops it is found that manufacturers are not in a position to replace depreciated and obsolete equipment, because of false accounting methods and improper business policies.

Accountants Confuse Depreciation and Obsolescence

All too frequently do we find accountants and business managers complacently setting up "5 per cent for depreciation and obsolescence," a most unfortunate form of expression, because it seems undesirable to combine these two accounts which are so radically different. Also, too little attention is given to the hazards of obsolescence. Repeated instances have come to the writer's attention

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*Chief Industrial Machinery Division, Department of Commerce, Washington.

Now Gaited for Better Business

How Simplification and Standardization Activities, Fostered by the Government, Have Given Industry a Spirited Stride for 1930

BY RAY M. HUDSON

"PROFIT planning," said Mr. Hudson, in transmitting the accompanying article, is becoming recognized as the true basis for all sales and production planning. "It marks," he urges, "a decided advance in managerial thinking from the days when it was taken for granted that mass production and volume sales would automatically yield profits."

Mr. Hudson is now secretary of the Massachusetts Division of the New England Council, with headquarters in Boston, having resigned his post in December as assistant director of the Bureau of Standards, in charge of commercial standardization.

INTEREST in waste-elimination as a modern source of profit continues unabated. Simplification, or the elimination of unnecessary varieties, "lines," patterns, models, and uses of commonplace commodities is being more widely applied than ever before. Wholesalers and retailers are applying simplification to brands carried and concentrating their selling efforts on fewer numbers. To date the Division of Simplified Practice of the U. S. Department of Commerce has helped to bring about 117 simplifications in as many different commodity fields, and is cooperating in the development of more than 50 others.

Standardization of grade and quality as a means of combating price wars, arising out of unnecessary quality differentials, is spreading into more and more fields.

Buying on specification is likewise spreading rapidly as the modern purchasing agent recognizes the importance of constant quality in his purchases and full value for his dollar.

Savings in Minimized Inventories

Shortening the process of conversion through eliminating waste motion and effort in all stages, from raw material to finished product—reducing inventories until they are chiefly in process or in transit—are two profit-making measures that will be widely employed in 1930, judging from present indications.

This eagerness for faster turnover of the inventory dollar and for lower unit labor costs is accelerating mechanization of industry, with coincident modernization of existing machinery, equipment, plant and methods.

In selling or merchandising, we observe increasing use of market analysis, intensive study of costs of doing business, and recognition of the fact that such research often yields profit where further efforts to increase volume do not. More intensive scrutiny of local markets is revealing that the sales berries are not so think on the farthest bush, and concentration of selling efforts in the markets more easily and economically reached from the point of production is adding to net profits by elimination of losses caused by covering too much territory.

Current trends in advertising show greater understanding of the fact consumer demand is more important than consumer acceptance. The act of buying is the source of profit—not merely the desire to buy. Modern advertising, in recognition of this, is being more intelligently done.

Vision and foresight as potent factors in business stability are demonstrated in recent executive decisions to hold to current wage levels, to rotate workers to furnish some income to all employees, even though temporary shortening of the working day, or number of days per week, has been necessary. The knowledge that markets are people, not plans, has centered attention on their buying power and the ways and means by which it may be perpetuated.

The contribution to business stabilization resulting from employment stabilization reflects a growth of community-mindedness that sees the maintenance of local prosperity as local responsibility. If every community is prosperous—there can be no question of national prosperity. The deductions which unemployment makes from national prosperity are becoming better understood and we may confidently expect to see greater cooperation among employers in keeping local labor fully employed.

Wider recognition of the great constructive value in the workers' contribution to the prosperity of the industry in which they are employed is shown in the many waste-elimination campaigns in factories and plants.

Mobilization of the workers' interest in reducing waste, decreasing costs, and increasing production will continue to spread as the profit-making potentialities of the workers' aid in these directions becomes generally understood.

Scientific Management Expanding

Scientific management, in its broadest sense and meaning, is the order of the day in manufacturing, merchandising, banking, city management and community development. Its increasing application marks a great advance in economic understanding. The results it produces are the best assurance of continued prosperity for the nation.

Scientific management—concentrated effort—work—will be the chief sources of better business and fair profits in 1930.

Business will be better, as the committee on Recent Economic Changes so forcefully pointed out, according to the intelligence and energy we all use in making it better. So why not meet 1930 with courage, confidence and cheer?

Seeking New Uses for Steel

What Group Effort Has Already Accomplished— For the Individual Such Selling Is Interesting and Constructive

BY C. H. WOODWARD

NINETEEN TWENTY-NINE has been a good year in the steel industry; but 1930 can easily be better. While yet far from showing the spirit and concerted action of some more profitable industries, individual manufacturers and fabricators of steel are becoming aware of the value of organized effort focused upon a definite objective. The steadily increasing percentage of steel being used for types of bridges hitherto sought only half-heartedly and the rising chart line indicating the use of more and more steel in buildings, large and small, is undeniable evidence of the momentum sincerely hoped for by a few clear sighted, hard working visionaries.

More than 50 per cent of the industry listened with a cynical smile a few years ago to programs outlined for the improvement of certain trade conditions, that promised increased volume and better profits. These plans are still far from being fully realized; but the demonstration of principles involved has been so enlightening that practically all the important manufacturers and fabricators of structural, plate and sheet steel are today solidly behind the movement for better business conditions within the industry.

This situation at least offers one outstanding advantage to those concerned, which alone should be worth all the effort expended to accomplish it. Manufacturers and fabricators of steel can and now do, as local and national bodies, consider intelligently and openly the practical possibilities and the opportunities presented from time to time for new uses for steel or better methods for the use of steel in markets already established.

In order, however, to function effectively and most successfully compete with other well organized industries, it is necessary that every individual manufacturer and fabricator shall with open mind, free from prejudice toward any innovation, take time to study thoroughly and give the best his training and practical experience affords to the consideration and development of every suggestion for mechanical and structural improvement or increased volume offered by any competent authority.

Engineers are not supposed to have imagination. Good salesmen always have it in abundance. The engineering profession, however, would never concede that the inspiration which prompted the conception and development of the first steamboat or the latest radio set came from a salesman of Fulton's day or ours. Hence some engineers do have it.

Instances the Battledeck Floor

Imagination, or vision if you like the word better, is essential to the commercial success of anything like the rapid development of arc welding of the past few years. Imagination tempered with, but not smothered by, technical conservatism should cause several hundred men to read the interesting paper on battledeck floors recently written by Lee H. Miller, chief engineer of the American Institute of Steel Construction—to read it carefully and ask for any further detail required. Then by demonstrating this method in practice in a new building or bridge roadway at the first opportunity, classify themselves as leaders rather than consistent trailers in their trade or profession.

"Radical" you may say, impractical you may think—today. They said that about railroad trains, within the memory of many men now alive. They said it also when some imaginative engineer proposed to pull instead of push motor cars.

The battledeck floor has been in service for many years in battleships and the charging floors of open-hearth furnaces, subject to more severe usage than any office or industrial building floor must withstand. Unless improvement and development incidental to its adaptation to building construction may classify this floor as an unknown quantity, then it has long since passed the experimental stage. Several buildings have been designed with battledeck floors and some are under construction. One large industrial building on the Pacific Coast is designed with a battledeck roof to be used as an airplane landing.

Urges H-Columns for Steel Piles

The steady increase in the use of standard H-column sections for piling under piers and for bridges and buildings represents large tonnage opportunities for fabricators and mills. These steel H-column piles, supplied at no greater and frequently less cost, are highly satisfactory. They also entirely eliminate the danger of splitting or breakage when driving through hard material. They are proof against all destructive insects which attack wood piling, and careful inspection of such steel piling shows practically no deterioration after years of submersion in fresh and salt water. The Pacific Western Oil Co. and The Honolulu Oil Co. have built piers at Ventura, Cal., using standard H-sections for piling. The piles range in length from 35 ft. to 60 ft. and the piers extend into the Pacific Ocean from 1000 to 1500 ft.

Steel for Grand Stands and Airports

We are by no means obtaining our share of grand stand, stadium, municipal, State and Federal airport construction, for all of which steel is so much better adapted than any other material.

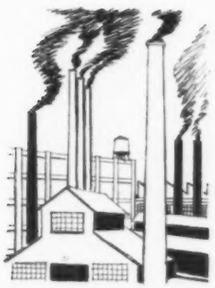
Much greater success for any or all of these and many other opportunities for new business may be ours if we will concentrate some determined and continued educational sales work upon them. Six months, however, of unified effort on the part of steel fabricators and steel manufacturers, constantly studying, demonstrating and selling such things to those who need and will appreciate the service we are qualified to give them will show a greater advance along the entire line than six years of go-as-you-please individual effort.

There is no humdrum routine about this kind of selling. It is interesting and constructive work. It is service that will show valuable returns to the steel industry and the thousands of users of steel and other materials.

Plant Growth Affects Management

Expansion Brings Need for Clear Cut Division of Authority and Detailed Records of Performance, Materials and Expenditures

BY S. J. HOPPER*



MANUFACTURING is defined as the operation of producing articles from raw or prepared materials by giving these materials new forms, qualities, properties or combinations, whether by hand labor or machinery.

In performing these operations in a modern factory, in order to obtain the lowest costs on the manufactured product, to turn out the maximum quantity of material in a given time and with a given equipment, and to maintain or improve upon the quality of work which has been set as the standard, it is necessary to arrange or dispose of the constituent or interdependent parts so as to form a systematic whole.

The manufacturing side of many establishments seems to be the last to receive any special consideration with a view to organization on a systematic basis, and it may be well to take the common case of a successful factory producing a commodity for which there is good demand, making some money and growing steadily, and examine the manner in which the growth and development of the factory finally forces organization upon the management.

The small factory has an internal economy evolved from very small beginnings and is much more likely to be thoroughly efficient in some details than in others. Very often the exact functions of the various officials are not strictly defined, so that they are not working at all times with perfect smoothness, but yet fairly satisfactory results are often obtained. Close acquaintance with such a factory and a careful scrutiny or examination of its workings always reveals a leading manager who may or may not rank as such, who exercises a general supervision over the conduct of affairs and who virtually carries the works on his own shoulders, and is overtaxed by responsibilities voluntarily assumed when clearly seen.

The output of the factory must be kept up to the demands and constantly improved, as well as cheapened, by added value or cost reduction or both.

The factory which is to continue in existence must advance, and the leading mind of this unorganized factory has first of all the advancement of the product in view. After this imperative demand for the betterment of the product, comes the improvement of the production elements, which shall increase the factory's labor hour efficiency. The third division of the factory manager's labor is the hateful drudgery of adjusting the faulty mechanism of factory routine so that this small delay or that evidence of hurtful friction or small clashes between minor officials may be alleviated, smoothed over and adjusted.

While the business is comparatively small the manager depends largely on finding suitable men to act as his subordinates, each of whom must perform more than one function and must have some latitude of development and who is oftentimes expected to, and does, judge for himself what he shall do and when he shall do it. As the volume of business increases, more of these minor officials are required and they are very hard to find. When this stage is reached the manager finds himself driven to the wall. His higher labors in the direction of production betterment and plant betterment cannot be transferred and cannot be put aside, and this work which no one can do for him he feels to be all that he can well perform, and he finally resolves to free himself from the annoyance of petty factory happenings, due to the want of intelligence or want of application on the part of his subordinates.

The manager has been careful in selecting these minor assistants; yet they do not meet his necessities. If forceful, they invade the domains of others; if willing but unenergetic, they fail to do their own work. The manager finds that each subordinate should have specific duties within the scope of his powers and that these duties should be clearly and rigidly defined.

Detailed Record-Keeping Essential

When the virtual dictator of an unorganized factory reaches this correct perception of the necessity of defining the duties of his subordinates and recording their performances, he at once becomes aware that the same reasoning applies to things as well as to men, to his normal equals in rank as well as to his subordinates. This perception immediately leads to factory organization in which duties and functions are clearly and rigidly defined, performance records are regularly made and the things of the factory are located when at rest and traced when moved. At any cost, then, the whole factory—men, deeds and material alike—must be placed and must be recorded. Form blanks must be printed, card index trays and cabinets must be installed, records must be made, duties must be defined; in short, the whole factory must become a machine in which every part and component is guided and directed in the certain performance of its intended function. When this is done, and not until then, the directing mind of the factory can be free to exercise his powers in the lines of mechanical and commercial advancement instead of wasting his efforts in correcting the irregular workings of the factory itself. When every man's duty is rigidly defined and accurately kept, records show that these duties are performed, and every piece and thing which enters the factory walls has its full story written down in comparable records; then the factory is organized and its highest usefulness may begin, and the manager may carry on and advance his establishment so far as the best use of his own powers will suffice.

In laying out such an organization, it follows as a matter of necessity that the methods appropriate to an older and simpler order of things will be largely unsuited to the conditions of today and that it is manifestly injudicious to attempt the combination of the latest and most

*Works manager, James Leffel & Co., Springfield, Ohio.

efficient methods of production with the antiquated methods of past generations. The more complex the subdivision of industrial work, the higher will be the type of organization required for effective operation, and while the single purpose of "profit at all hazards" suffices to make a small undertaking flourish, much more is necessary in manufacturing operations on the vast scale now commonly obtaining.

In planning and deciding upon the proper organization, all subdivisions should receive such consideration as will insure their being organized and developed along lines which are not only best suited to their own requirements, but in a manner which will result in the highest cooperation between them and the other subdivisions which their work affects under the general organization scheme.

Overlapping Authorities Must Be Avoided

It is obviously a most important matter that the persons selected for the various staff positions should be individually adapted to the duties expected of them. Unless care is exercised in the allotment of the work to those who have to perform it the result is often most unfortunate, because men who are perfectly willing and capable in certain directions are placed in positions in which their energies are wasted and in which they work unwillingly and therefore incapably.

The question of staff precedence is also one which deserves more attention than it usually receives and is very often the source of jealousy among employees. Under no circumstances should any members of the staff be given dual or overlapping control of one or more departments. It is imperative that every member have a clearly defined position and be made to understand in unmistakable terms to whom he is to look for orders. Otherwise continual bickerings and consequent disorganization are inevitable.

It should also be understood by every member of the staff, particularly in minor positions of responsibility, that they must exercise self-control and not ride rough-shod over those who happen to be their subordinates. It should be impressed upon them that when deciding internal questions or disputes, as is frequently necessary, strict impartiality and firmness are essential, so that the natural confidence which should exist between supervisors and their subordinates may not be disturbed. Indeed, fair play is the essence of discipline, and discipline tempered by sound common sense is the groundwork of a business of any kind. It pays employers to consider the comfort of their employees at all times. Satisfaction and contentment are the best guarantees for the retention of an industrious and steady class of help, and it is essential above all that a feeling of security should exist throughout a factory, since nothing is more calculated to unhinge the nerves and produce a feeling of recklessness or a desire for change than a constant dread of dismissal at short notice.

All Expenditures Must Be Watched

All manufacturing operations have for their main features one characteristic in common, namely, a series of expenditures of cash merged and sunk in various ways according to the nature of the transactions, followed by their reappearance in the shape of receipts, the amounts so received over a given time being as much greater or less than the expenditure as the business is of a profitable or unprofitable nature.

In proportion as these operations become complicated by the introduction of other factors, such as the variety of product, variations of the rate of production, defective work and the many expenditures of a large establishment, it is necessary to provide other and more reliable methods of ascertaining from time to time the state of affairs.

When we come to the conversion of raw material and labor into salable products, there is in addition to the complicated transaction of an extensive buyer a series of operations to be watched, the supervision of which demands a rigorous method of accurately and swiftly realizing the progress made. The active forces of production, if not guided and controlled with intelligence aided by the most accurate information as to the value of the work done and the expenditure incurred, have an inherent tendency toward annihilation of profit and even disastrous loss. In this inherent tendency of productive forces to go astray and of organization to decrease in efficiency lies the importance of the complex reports made at short intervals of the many operations of the interior of a large manufacturing establishment.

One of the most prevalent sources of danger to the prosperity of a large establishment and against which it is necessary to be continually on guard is that of extravagance. As it is most frequently to be met with in those who are responsible for the small expenditure, it is a danger which, being insidious, requires careful attention.

The responsibility for it must necessarily rest with the department heads and they should be instructed to give encouragement to those who practice economy.

Our experience leads us to believe that details constitute much of the difference between good and bad management. All bad habits have small beginnings and the neglect of small things eventually leads to the neglect of greater ones.

Trends in Market Management

(*Concluded from page* 71)

which has introduced the new words in the marketing manager's vocabulary.

The marketing manager is now beginning to use real research to find his markets and ascertain their characteristics. He is more anxious to measure his accomplishments against his possibilities than against his past records. His quotas have some fair statistical basis in place of pure opinion. He attacks the wastes of field work by planning the routing and frequency of call of his salesmen. He is more interested in sales figures by customers than in sales figures by salesmen.

The problem of waste, or of reduction of sales cost he attacks by better classification of products and customers, and by the skillful use of incentives, both psychological and economic. He works with written plans and budgets and acquires a profit viewpoint which helps him to cooperate for the good of the whole company instead of seeking only a personal record of success.

In the end he finds himself working with the thought that a plan must precede a method of control, that the statistical development of trend curves helps to prevent exigencies and failures, and that proper measurement requires prior establishment of performance standards.

Put Profits Into New Equipment

(*Concluded from page* 72)

where, when the critical moment arrives and replacement must be made, it is discovered that the only way to meet the obsolescence loss is to subtract it from dividends, which means, of course, that management has failed to recognize this factor among the costs of production, and consequently has failed to cover these items in arriving at sales prices.

That part of the President's program that covers "repairs, improvements and replacements" is in reality a suggestion that industry catch up with progress—that it take advantage of all new developments. But when we have progress we also find obsolescence and this program is also a plea for adequate accounting in order that industry may be protected from loss through neglect of these less obvious costs.



Economic Movements in Metals and Metal Working

"What may we expect in the near future?"

That question will be asked by many a business man on New Year's Day. Any intelligent answer must be based on such analyses and data as are printed on the following pages, and a judicious weighing of the counteracting trends in different portions of the industry.

It will be seen that the whole world produced iron and steel at an unprecedented rate last year. Great quantities of copper, tin and zinc were also mined, without reaching capacity operations. But is steel, as automobiles are believed by one contributor to be, in a "closed market", and is the normal increase more like two per cent than the ten per cent actually gained last year in world production?

Will mergers cut the cost of distribution, or are there still satisfactory profits in an intensive cultivation of a restricted market by local producers. Can various branches of the industry regain satisfactory earnings despite expanded capacity?

Perplexing problems, but undoubtedly best answered in the light of definite facts found by research and enforced by cooperative action.

Individual Is Key to Prosperity

Industrial Equilibrium, Now So Emphasized, Rests on Economic Status of Rank and File—Cooperative Effort Must Be Extended

"THE aftermath of the stock market crash has focused attention on industrial stability, the social responsibility of the business leader and the material welfare of the individual as major factors making for a sound and healthy prosperity," said Henry Bruère, vice-president, Bowery Savings Bank, New York, in an interview with a representative of THE IRON AGE.

"We Americans have lately been victims of a grand illusion," he continued. "We gradually became so drugged that we could not recognize facts. We came to believe that we were on the way to a new technology that would raise to unbelievable levels the earnings of business enterprises. No one proved entirely immune to that viewpoint. It was a case of mutual and autointoxication.

"The awakening was marked by the pooling of business leadership at Washington to cope with a situation that was frankly recognized as a crisis. This conscious integration of business brains was a great forward step in our economic development. Looking back, however, it seems too bad that we had to wait for the impelling force of fear. Fear does not stimulate clear-thinking and usually results in the coloring of facts under consideration. Under such a condition men are likely to calculate what they say, so as to avoid a contagion of pessimism. The possible consequence of this is the setting in motion of another round of self-deception.

Collaboration of Rank and File a Prime Need

"Commendable and necessary as group planning by business leaders is in itself, the best fruit of it is the quickening of every business man to appreciate that he can, and should, cooperate with others in his immediate sphere. Leadership is essential to set the pace, but intelligent collaboration of the rank and file is more important.

"The individual, whether as business man or as citizen, to my mind looms large as the key to our problem. The idea that the American people are robots has been exploded. The masses cannot be made into gutters into which ever-swelling floods of commodities can be sluiced.

"Perhaps no greater influence for stability exists at the present juncture than the public's investments in insurance and savings accounts. More than one hundred billions could not be put into insurance without affecting our whole social organism.

"The savings habit engenders prudence and concern about the future. Here in our own institution a quarter of a million people have accounts—each one bent on placing himself where he can continue as an active economic unit in any crisis. The economic independence of the individual enables him to think clearly and to act calmly in time of stress. It tends to relieve a situation that, from a collective point of view, might otherwise become more tense.

Real Prosperity Rests on Proper Habits of Life

"I know, from my experience in the insurance business, that it is still unhappily true that many do not escape dependence or destitution in old age, but I nevertheless believe that a general economic status is attainable in which only actual destruction of property and the disability of human beings would affect consumer buying.

"The comparatively new idea that poverty is not inevitable—a concept that appeals to everyone—is now commonly accepted in this country. Consciously or subconsciously we are all striving for general material well-

HENRY BRUERE has had a varied experience in banking, business, industrial relations and civic affairs. Now first vice-president and treasurer of the Bowery Savings Bank, New York, he was from 1923 to 1927 third vice-president of the Metropolitan Life Insurance Co. In the seven years prior to that he was vice-president of the American Metal Co., Ltd. He was financial advisor of the Republic of Mexico in 1917 and 1918, and from 1914 to 1916 was chamberlain of the City of New York, in charge of the administrative reorganization of the muncipal government. In 1911 he made an administrative survey of 10 commission-governed cities in the United States and in the following year made a similar survey of six German cities. In 1903 he engaged in an investigation of industrial welfare work for the International Harvester Co., Chicago. Born at St. Charles, Mo., Jan. 15, 1882, Mr. Bruère attended Cornell University and the University of Chicago, later studying law at Harvard University and New York University and political science at Columbia University. He is a member of the New York bar and vice-president of the Taylor Society.



being. In the past we attributed economic crises to uncontrollable external forces. Today we realize that we bring everything on ourselves and that the remedy lies with ourselves. We know that at the foundations of all real prosperity lie proper habits of life, conservation and building up of wealth, improvement of technique in production and distribution, a vision of what we ourselves would become, what we would have our nation become, and earnest, painstaking effort to help one another. You can't have universal welfare without what Dr. Adler calls the 'fellow-man' spirit. While we need most to discover ways of effective cooperation, the individual's house must be in order if the total situation is to be kept in equilibrium.

"When vice-president of the Metropolitan Life Insurance Co. in charge of its economic services, particularly in cooperating with industry to develop group insurance, I became interested in stabilization both from the viewpoint of business as a whole and from the standpoint of the individual. We inaugurated the 'Stabilization of Business' series of bulletins, in which we attempted to cover all aspects of what was being done in that direction. Among the subjects studied were trade association work, budgeting, cost accounting and the prevention of seasonal employment in industries. We also held conferences on timely subjects—a practice that has been continued with excellent results. I recall a meeting of 200 business men at Chicago that was devoted to a discussion of hand-to-mouth buying and its stabilizing effect on the flow of trade.

Must Stabilize Human Living to Stabilize Business

Effort and money were spent by the insurance company for the purpose of clarifying business so that business might operate on a stronger basis. Interest in the individual was paramount because the *sine qua non* of group insurance is keeping people employed. We tried to find the elements that stabilize human living and at the same time stabilize our economy as a whole.

"Our undertaking was part of that conscious integration of business effort, in recent years, which has aimed at a better understanding of how each economic element works on the whole in effecting, nor merely profitable operations, but stability and progress.

"The increasing vogue of cooperation in business has been accompanied by more intelligent policies. Business is learning what is the judicious and proper thing to do. It has cured itself to a large extent of overproduction and overconsumption. It still has an unsolved problem in the stock market, which remains too much of a mixture of legitimate enterprise and ignorant or deliberate gambling —but that is too big a question for adequate discussion here.

"The ability to cooperate and to share views requires further cultivation. The hardest thing for men to do is to enter into genuine cooperation that involves relinquishing habits. They want to collaborate, but they are inhibited by assumptions, fears, antagonisms and mental isolation.

Cooperation of Smaller Units Needed

"The council formed under the auspices of the Chamber of Commerce of the United States is a dramatically large unit of cooperation, but more effective work, in my opinion, can be done by smaller units. I believe, for example, that the savings banks of New York could well make a joint study of their relation to the economic thinking and the economic welfare of the people of the metropolitan district. Such a survey would uncover what could or should be done to build up individual savings reserves. The metropolitan area now has three and one-half million savings depositors with accounts totaling $3,500,000,000, but we probably have only begun to meet the need of general individual security and provision for larger opportunities.

"I have always been impressed by the stabilizing procedures of certain of the large utilities. The American Telephone & Telegraph Co., for example, has a five-year program that permits of a well-ordered expansion in step with the actual requirements of a growing population. This large organization is able to keep in touch with all phases of the problem confronting it. By pooling all the facts assembled and bringing to bear on them the combined technical and executive ability of the company, policies are determined that fit the needs of the public.

"I believe that every economic unit in its given sphere should have the benefit of the combined wisdom of the group to which it belongs. The problem of individual businesses is to strive for as full an understanding of the field of work in which they are engaged as is possible.

"President Hoover summoned the business leaders. I should like to add: 'Let us summon ourselves.' Some of us may have been softened by the recent period of 'easy money' on Wall Street. It may be that our methods, our technique have suffered. We may have been content to retain more or less obsolete, inherited or traditional ways of doing business.

"How many a business man applies the methods of research which he lauds in the great enterprises, to the processes of his own business? Does he get out of his own organization the latent powers for cooperative thinking that have never been developed? Does he recognize the fact that, although it is a human tendency for everybody to live in his own cubbyhole, there are ways of breaking down his natural reserve.

Every One Has a Responsibility

"In our present-day economy every one counts and every one has a responsibility. If the seeds of instability are not sown again, it will be because the individual has divested himself of cynicism, laziness, flabby-mindedness, day-dreaming and gullibility. We have been prone to believe that the milennium is just around the corner. We have liked to think that miracles are about to happen.

"I believe that it is radically wrong for managements to expect their organizations to produce bonanzas or Eldorados. The object of business is not to accumulate unlimited profits. We have a common stake in prosperity and we need an equilibrium in which prices, profits and wages insure us a steady, sound economic growth.

"When this is understood and practised there will be less temptation to 'discount the future' in attempting to keep abreast of the progress of the country."

Operations of Steel Industry Will Improve —James A. Farrell

"It is confidently expected that after the turn of the year operations in the steel industry will substantially improve," says James A. Farrell, president, United States Steel Corporation. "In heavier products, such as railroad materials, structural steel for buildings, bridges and ships, there is a large demand even at this season of the year, with prospects of a capacity demand in the near future. The release of public and private work and new construction for utilities in various lines, will soon be felt, aside from which, steel for general purposes will supplement the heavier line tonnages above referred to.

"There has been no inflation in prices, inventories, or in capacity, and there is no apparent reason why 1930 should not be a good average year, with stable prices and stable wages."

New Records in World Iron and Steel Output Last Year

Total for Steel Was Nearly 118 Million Tons American Part About 48 Per Cent—Pig Iron Over 96 Million—New High in World Exports

PIG iron and steel output of the world again surpassed all records last year. Expansion in pig iron for 1929 was larger than in steel—in 1928 the reverse was true. Steel production for 21 countries, at 117,850,000 gross tons, was 9 per cent larger than the 108,220,000 tons of 1928. Pig iron at 96,180,000 tons was 10.6 per cent in excess of the 1928 total of 86,960,000 tons.

American steel output including castings exceeded 56,000,000 tons, a new record by a wide margin, and pig iron made a new high, beating its previous record of 40,361,146 tons in 1923 by 5.8 per cent.

Iron and steel exports of the leading nations were at a new high level.



RECORD production by the American steel industry in both steel and pig iron was paralleled last year by large increases in all major European countries. As a result new world records were made. This is shown in detail in the accompanying tables, which are based on data from the National Federation of Iron and Steel Manufacturers, London, England, furnished largely by cable.

Pig iron output for the world approximated last year 96,180,000 gross tons, with data for the last month or two estimated. This is an increase of about 10½ per cent over the 86,960,000 tons of 1928. It is nearly 24 per cent in excess of the 1913 production of 77,720,000 tons, which has now been surpassed three times since the war.

Increase in world steel output was not so large as that in pig iron. The 1929 estimated total is 117,850,000 tons. This is nearly 9 per cent larger than the 1928 revised total of 108,220,000 tons. The great strides made in steel since the war are shown by the nearly 60 per cent increase over the pre-war, or 1913, performance. By contrast the corresponding pig iron advance is 24 per cent.

European Countries All Show Increases

The 15 European producing nations, made 50½ per cent of all the pig iron last year, the amount being 48,630,000 tons. In 1928 the proportion was 51 per cent, or 44,360,000 tons.

In steel last year 14 European nations made 57,050,000 tons, which is 48½ per cent of the world total. In 1928 it was 52,530,000 tons, also 48½ per cent.

Germany was among the major producing nations that made a new post-war record in both pig iron and

Table of World Production of Pig Iron in Millions of Gross Tons

Country	1913	1925	1926	1927	1928	1929*
United Kingdom	10.26	6.26	2.46	7.29	6.61	7.50
Germany	16.50	10.01	9.50	12.90	11.62	13.10
France	5.13	8.36	9.28	9.15	9.82	10.30
Belgium	2.45	2.50	3.35	3.69	3.84	4.00
Luxemburg	2.51	2.33	2.52	2.69	2.73	2.83
Saar	...	1.43	1.61	1.74	1.91	2.10
Russia	4.49	1.53	2.40	2.92	3.22	4.09
Poland	...	0.31	0.32	0.61	0.67	0.70
Norway	...	0.08	0.08	0.08	0.08	0.10
Sweden	0.73	0.45	0.49	0.41	0.43	0.48
Italy	0.43	0.50	0.50	0.53	0.56	0.58
Austria	2.34	0.37	0.37	0.43	0.45	0.46
Hungary		0.09	0.19	0.29	0.30	0.28
Czechoslovakia		1.28	1.07	1.24	1.54	1.50
Spain	0.42	0.46	0.50	0.60	0.58	0.61
United States	30.97	36.70	39.37	36.57	38.16	42.70
Canada	1.01	0.60	0.80	0.77	1.08	1.18
Australia	0.04	0.44	0.40	0.55	0.41	0.42
India	0.20	0.89	0.90	1.15	1.05	1.11
Japan	0.24	0.91	1.16	1.26	1.50	1.47
China	...	0.38	0.40	0.40	0.40	0.67†
Total	77.72	75.88	77.67	85.27	86.96	96.18

*Partly estimated. Lorraine's output is included in Germany's in 1913, but in that of France since 1918.
†Includes other countries.

Table of World Production of Steel Ingots and Castings in Millions of Gross Tons

Country	1913	1925	1926	1927	1928	1929*
United Kingdom	7.66	7.39	3.60	9.10	8.52	9.70
Germany	17.33	12.00	12.15	16.06	14.29	16.25
France	4.61	7.33	8.30	8.14	9.35	9.45
Belgium	2.43	2.51	3.32	3.66	3.87	4.05
Luxemburg	1.31	2.05	2.21	2.43	2.53	2.65
Saar	...	1.55	1.71	1.86	2.04	2.15
Russia	4.76	2.11	3.08	3.53	4.18	4.65
Poland	...	0.77	0.78	1.23	1.41	1.45
Sweden	0.58	0.47	0.49	0.49	0.57	0.62
Spain	0.30	0.57	0.68	0.65	0.78	0.80
Austria	2.59	0.46	0.35	0.55	0.63	0.65
Hungary		0.23	0.20	0.46	0.48	0.48
Czechoslovakia		1.48	1.55	1.60	1.95	2.00
Italy	0.92	1.76	1.75	1.57	1.93	2.15
United States	31.30	45.39	48.29	44.94	51.54	56.15
Canada	1.04	0.76	0.78	0.92	1.24	1.45
Australia	...	0.35	0.35	0.52	0.46	0.42
India	...	0.45	0.52	0.57	0.41	0.50
Japan	...	1.32	1.48	1.70	1.84	2.00
China	...	0.20	0.20	0.20	0.20	0.28†
Total	74.83	89.15	91.79	100.18	108.22	117.85

*Partly estimated. Lorraine's output is included in Germany's in 1913, but in that of France since 1918.
†Includes other countries.

steel. Russia's recovery also was a feature. Canada's large contribution to the world total was outstanding.

World Exports Expanded

EXPORTS of iron and steel from the six leading nations were vigorous in 1929. Estimates place the total at 20,999,000 tons against 20,700,000 tons in 1928. The American total reached a new high since 1920.

Imports into these six countries again fell off the estimated total being 6,140,000 tons, contrasting with 6,610,000 tons in 1928. The United States, Great Britain and Germany showed decreases; the others, increases.

In exports Germany led at 5,400,000 tons last year, a marked expansion over the 4,640,000 tons in 1928, replacing France which was first in 1928. Germany was the largest steel exporter before the war and has again resumed that rank. The recovery of Great Britain is also notable.

Table of Steel Exports and Imports of Leading Countries in Millions of Gross Tons

Exports	1913	1925	1926	1927	1928	1929*
United States...	2.89	1.68	2.06	1.94	2.35	2.54
Great Britain...	4.97	3.73	2.99	4.20	4.26	4.40
Germany	6.20	3.21	4.82	4.23	4.64	5.40
France	0.58	3.86	4.13	5.60	4.99	4.25
Belgium	1.55	3.15	3.71	4.61	4.46	4.40
Total	16.19	15.63	17.71	20.58	20.70	20.99
Imports	**1913**	**1925**	**1926**	**1927**	**1928**	**1929***
United States...	0.25	0.84	1.02	0.69	0.69	0.68
Great Britain...	2.23	2.72	3.74	4.41	2.89	2.76
Germany	0.30	1.18	1.03	2.23	2.02	1.47
France	0.17	0.17	0.18	0.13	0.14	0.23
Belgium	0.87	0.53	0.60	0.64	0.87	1.00
Total	3.82	5.44	6.57	8.10	6.61	6.14
Export excess..	12.37	10.19	11.14	12.48	14.09	14.85

*Partly estimated. Luxemburg included in Belgian total. *Scrap not included in these data.*

Closed Markets Limit Mass Output

Production of Consumer Goods, Such As Automobiles or Vacuum Cleaners, Is Restricted When Replacement Basis Is Reached

BY W. W. HAY

MARKETS for consumers' goods, such as vacuum cleaners, washing machines and passenger automobiles, are said to be closed when consumers have satisfied their needs and further demand is limited to the replacement of worn-out and of old models. So long as demand continues unsatisfied the problem of the manufacturer is one of production; when the market becomes sufficiently satisfied through buying, it becomes necessary to stimulate demand by sales methods.

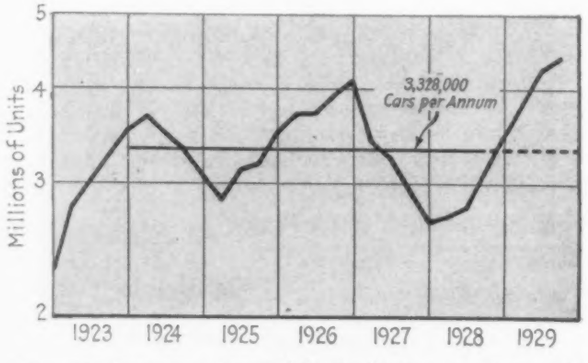
Production curves of consumers' goods of this utilitarian character exhibit cycles of expansion and contraction corresponding closely to so-called "business cycles," and this similarity is in itself an indication that the market has become closed. More certain evidence of such closed markets is slow growth over several years, the rate of growth, if any, being usually a little greater than present growth of population and a little smaller than the estimated increase of national wealth.

Vacuum Cleaners Have Passed Initial Growth

The household vacuum cleaner industry is a typical example of a closed market. Here the cycles of production are well defined and the trend of growth is slightly upward. The household washing machine industry is now in a similar market. The development of the electric washing machine was very rapid until two years ago, but today the sales of electric machines and the state of the industry give evidence of being in a closed market. Both of these industries are now characterized by various expedients of merchandising—intensive advertising, new models and price appeal.

As markets expand, each manufacturer finds a certain part of the demand for his goods and in the course of reaching maturity his proportion tends to a somewhat unchanging part of the whole production. Consequently, in a closed market, gains made by one manufacturer are almost always the losses of others. When sales are stimulated by a maker to increase his volume of business beyond what has been his fair share of the market, a trade war usually ensues and in due course of time some recover the lost ground and others eventually drop out.

The rise of the automobile to its present position as one of our greatest industries is familiar to all. Immediately after the World War the demand for passenger cars increased production tremendously. Reduced costs enabled prices to be lowered, and new buyers were attracted. Meanwhile the construction of well-paved streets and of



Domestic Passenger Automobile Production in Terms of Three-Year Averages Shows No Growth. The line represented by the three-year average has a mean departure of but 2.3 per cent from a horizontal line through the arithmetic mean of all the points plotted

hard-surface highways made the automobile more useful and thus opened other markets to all manufacturers. The effect of one or another of such developments and the opening of new markets have been the cause of the healthy increase in the production of automotive vehicles.

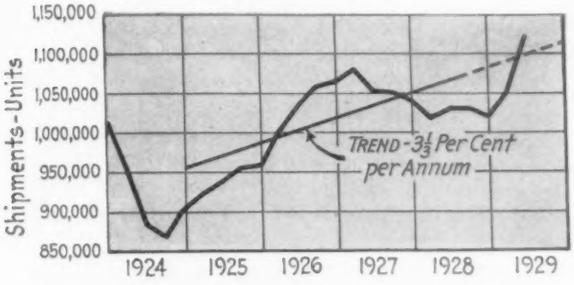
Demand for Passenger Automobiles Stands Still

But as long ago as 1924 the domestic market for passenger cars apparently became a closed one. A survey for the last seven years of domestic production, less exports, of passenger automobiles leads to this conclusion. The trend of this part of automotive production has been horizontal, representing no growth, but there are indica-

tions that from now on we may expect growth at least equivalent to that of other closed markets—between 3 and 4 per cent every year.

Expects Low Automobile Production

Let us concede for the sake of the argument that the domestic car market is closed—then any increased share taken by one make must be at the expense of others. It has been freely admitted in the automotive industry that in 1929 the Ford Model "A" took business from others, and that Chevrolet took business from others in the six-



A Closed Market for Household Vacuum Cleaners Is Indicated by Slow Growth of Shipments, as Represented by Three-year Average Trend Line

cylinder class—characteristic evidences of the operations of a closed market.

Estimates by the leaders in this industry are already undergoing a scaling down for 1930, but the market has invariably been overestimated before each year, greatly so before what proved to be years of contraction, or depression, in business. Present indications are that the production of passenger cars for domestic registration should not exceed 3,300,000 cars in 1930, compared with the probable 4,375,000 cars produced for this market during 1929. This reduction would not be remarkable in view of registrations so far and of large dealers' stocks overhanging a contracting market.

When Mass Products Exhaust Their Markets

Mass methods of production and distribution have been the cause of quickly closing comparatively new markets, and usually the capacity to produce continues increasing more rapidly than the number of buyers. In mass production falling prices result from a high rate of production and, as the price is brought down to a level where a new group of consumers feel that they can afford the article, the market continues to expand. When a market has absorbed all that it will under the conditions, rapid growth is halted and production during poor times may be limited to replacing used-up or worn-out articles. During periods of prosperity a certain number of owners of old models will buy new models—for style, or new features, or as a matter of real economy. Any additions are from growth of population and from increased wealth. Moreover, as the rate of production slows down or is actually reduced, prices should be increased. However, the presence of excess capacity will tend to increase competition and to lower prices at the expense of profits.

Call for New Articles at Low Prices

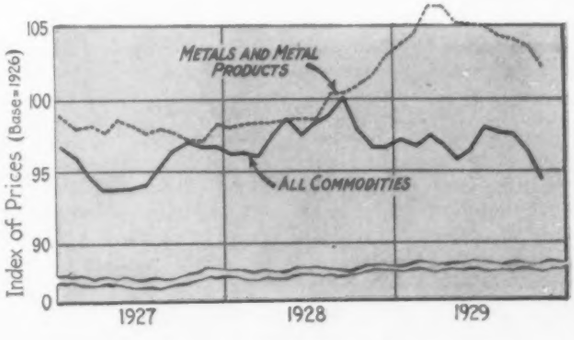
The manufacturer in a closed industry or market should, when entering the cyclical period of contraction so easily anticipated from past records, be prepared to offer a completely new article giving better value at a lower price, which brings the article manufactured within the reach of a new group of buyers. The time to stimulate buying is during periods of business depression, for in addition to opening new market levels, a demand may be created that will carry on through the following wave of prosperity.

Wholesale Prices Lowest Since 1927

BEGINNING in August, there has been a steady drop in wholesale prices of commodities from the year's maximum of 98, reported for July by the United States Department of Labor. The figures are relative to 100 as the average of 1926. The November index of 94.4 is the lowest since 94.1 was registered in July, 1927. Only once in all that period did the index reach 100, that being in September, 1928.

Metals and metal products showed a fairly continuous ascending curve from 1927 up through 1928 and into the early months of 1929. The decline in the last few months has not brought the price below 100 relative to 1926, but it is only a short distance above that figure. That metals are above the general curve is owing to the relatively lower prices of metals, including non-ferrous, in 1926, the base year.

In the diagram are the curves of these two price indexes—that of 550 commodities at wholesale, which make up the entire list, and that of metals and metal products, comprising 73 quotations, or rather more than one-seventh of the total.



WHOLESALE Prices in General Have Been, in 1927, 1928 and 1929, Consistently Below the 1926 Average, Touching It Only Once. Metals, on the other hand, have been well above the low 1926 level for more than a year

Status of the Stainless Steels

Development of the "18 and 8" and Non-Corrosive Alloys—Ideas on Nomenclature—A New Industry's Future

BY T. HOLLAND NELSON*

IN reviewing the subject of stainless steels one is apt to carry one's mind back to the early days when Brearley in England was looking for a suitable material for a gun lining; when Dr. Strauss of the Krupp laboratories was experimenting with alloys for pyrometer tubes, when Elwood Haynes of Kokomo and C. M. Johnson of the Crucible Steel Co. of America were developing alloys of the nickel-chromium types and when P. A. E. Armstrong was doing his pioneer work.

The Early Developments

Many and varied have been the results that have proceeded from the work of these four pioneers by themselves and by other workers.

The first real commercial development from Brearley's efforts to produce a gun lining was stainless steel for cutlery. From Dr. Strauss' particular endeavors came many of the early nickel-chromium materials which have not only proved extremely useful in the field of corrosion resistance, but various other combinations have attained the object for which they were originally intended, that of being resistant to oxidation and scaling at high temperatures. The work of Haynes and Johnson has been closely interwoven with the work of the two previously mentioned metallurgists with the result that we now have something concrete and definite.

The original stainless steel has been the subject of modification and improvement by many workers and also, of course, by the original inventor himself, with the result that the early difficulties which were experienced in producing a stainless steel knife with a decent cutting edge have been substantially overcome by the introduction of higher percentages of carbon and the introduction of other alloys such as nickel, tungsten, cobalt and so on.

Appearance of the "18 and 8" Alloy

PERSEVERANCE with the nickel-chromium alloys has ultimately led to the development of the materials we so readily designate today as "18 and 8." This material is practically interchangeable in all cases with straight stainless steel or chromium-iron, and, having the advantage in many cases of increased ductility, has made possible the fabrication of many complicated shapes.

Special mention should be made of the fact that the serious difficulties, experienced whenever it was attempted to weld either stainless steel or chromium-iron, have been almost removed by the introduction of the nickel-chromium type of materials. Grain growth and embrittlement, to say nothing of general physical weakness, experienced with welded chromium-iron were extremely disappointing to those who desired welded work.

Introduction of the "18 and 8" alloys, which are austenitic in practically all conditions and not by any means so susceptible to grain growth, was readily taken up by those interested in welded work and has proved very valuable in this field. The stainless or corrosion-resistant alloys vary considerably, from material that can be hardened and tempered similar to ordinary steels to alloys which are austenitic and more or less immune to heat treatment. The physical properties also vary over a range that represent materials almost as soft and ductile as our mildest steel to materials which can be made as hard as some of our hardest tool steels.

Some Thoughts on Nomenclature

IF there be anything unfortunate in the history of the development of these alloys, I would say that it was the term that has been given to them—by this I allude to the word "stainless" and more particularly still to the further addition of either "steel" or "iron." It is natural enough to the man who is regularly handling either iron or steel to have used these two metals as a standard, but as development in these materials progresses it becomes that much more difficult to define.

The word "stainless," of course, was the name originally chosen by a cutler who found that a table knife remained bright and stainless under certain conditions. We all have a tendency to judge within the sphere of our own particular knowledge and to that particular cutler the word "stainless" seemed to be quite symbolic and to cover his field truthfully and honestly. Because of the fact that the material could be hardened and tempered it was quite natural to call this material steel also.

As further developments of this material progressed and a more ductile material was produced it was, I suppose, only natural by comparison to call this material "iron." The progress that has been made with the nickel-chromium alloys complicates this issue considerably because of our readiness to refer to the nickel-chromium materials as alloys.

It would be well if we could bring our minds to consider all these stainless or corrosive-resistant materials as distinct and separate alloys, far removed from the ordinary classifications of iron or steel. Some of our leading societies are at present working on this problem and it is hoped that the situation will be clarified before long.

Early Progress of the Art

A REVIEW is intended to give in concrete form an idea of the progress an art may have made and what are the possibilities of its future. In this direction, therefore, let us review the development of stainless steel.

The first commercial article produced was a table knife. From this stage the industry progressed and material was introduced in the form of pump shafts, turbine-blading, various parts of hydraulic equipment, etc. For quite a while the products seemed to be limited to the output of either the bar mill or the forge. The largest impetus the industry received was when Messrs. E. I. DuPont DeNemours built their first nitric acid equipment at Ripano, N. J.

This, of course, necessitated the production of one of the alloys (chromium-iron) in the form of plates, angles,

*Consulting metallurgist, Widener Building, Philadelphia.

channels, tubing, shapes in general, rivets, etc. Towers, 10 ft. in diameter by 60 ft. high, were fabricated of this material because of its proved resistance to nitric acid. Since that time, less than four years ago, there have been erected many installations involving several millions of dollars.

Chrome-Nickel-Silicon Alloys

The chrome-nickel-silicon alloys of the corrosion-resistant type developed by C. M. Johnson, have been steadily finding wide applications in the field of corrosion resistance and in this direction it should be noted, by those interested, that the high-silicon content of these materials has proved extremely advantageous in many cases of corrosion which could not be handled by either the chrome-iron or nickel-chrome alloys.

This increased silicon content has also a distinct advantage in the field of heat resistance or scaling at high temperatures, and substantial tonnages of this type of material are being used for such articles as carburizing boxes, annealing pots and general furnace parts operating at temperatures from 2000 deg. Fahr. down.

Late Developments in "18 and 8"

It is within practically the last year or so the real serious development of the materials known as "18 and 8" have taken place, and in this case the demand of the user for a material offering wider possibilities in manufacture have been responsible for the tremendous strides that have been made with this type of alloy.

Today it is practically safe to say that there is little that one could ask for in some particular grade of ordinary iron or steel that cannot be duplicated with one or other of the straight chrome or nickel-chromium alloys. Keen cutting edges have not been easy to obtain with some of these alloys. This, however, has been surmounted by various developments, and today we have not only table knives but safety razor blades, surgical instruments, etc., and many other such articles with a growing demand for them.

There is a distinctly increasing demand in the field of ornamentation where chrome plate is not altogether satisfactory as well as for general utility. Take the Chrysler Building as an example; this is to have a chrome-nickel alloy tower and chrome-nickel alloy window casings on several floors. Or the field of tableware, now held by silver and various high-nickel alloys. Tableware of all types is available in so-called stainless material today and is rapidly replacing many of the alloys which tarnish so readily.

The various departments of the Navy have done and are still doing a great deal to foster the development of this material. Submarine periscope tubes, cables and a variety of other parts are being made from these alloys and their use is gradually being extended wherever price warrants their use.

Then, again, there have been limitations in the production of springs, because it was practically impossible to harden and temper some of these materials to produce a full temper such as was necessary for springs themselves and for such articles as saws and various other places where spring temper was desirable. Strange to say, the production of the spring temper has not only been produced from the group of materials which are capable of being heat treated, but very fine springs are being produced from some of the austenitic chromium-nickel alloys by the age-old process of cold working and producing work hardness or temper hardness by mechanical means.

Application for Heat Resistance

Use of these alloys has become increasingly large, not not only in the field of corrosion resistance but in the still only partially explored field of heat resistance. Today the oil fields are using substantial tonnages in a variety of forms, such as bars, seamless tubing, castings, etc., for use in refineries at elevated temperatures where the physical strength of the material should be as high as possible and the ability of the material to resist scaling is essential.

Future of This New Industry

THOSE who are interested in the subject, of course, have kept more or less apace with its developments through the various trade journals from time to time, but I have often been asked what I consider the future prospects of this comparatively new industry.

One may say that the materials we have before us now may by no means constitute a limit. I believe that the rapid strides that have been made in chromium plating are substantially due to the proved worthiness of the chromium alloys.

Then, again, we have within recent months the development of nickel-silicon alloys with and without chromium. I refer to alloys containing as high as 5 per cent silicon which have been found to resist sulphuric and hydrochloric acids, both of which solutions seriously attack the chromium-iron and nickel-chromium corrosion-resistant alloys obtainable prior to this development.

So that, as our knowledge becomes greater, the development of different alloys to withstand various types of corrosion will take place, and whereas we started with chromium and iron, then, for a variety of reasons, accepted the addition of nickel and now the improved value of alloys with a substantial addition of silicon for certain purposes, so will the demand of either the user or the manufacturer produce changing alloys from time to time to meet specific conditions.

Many times I have been accused of being a dreamer, but at least I can carry my mind back to the old clay crucible in Sheffield that produced the first stainless steel. At that time no one thought of anything but gun linings, and to have prophesied such structural developments as the installations for the nitric acid plant at DuPont might have been termed insanity. Yet within the space of a few years all these are accomplished facts and have opened up tremendous possibilities in the various fields where they are operating.

These Alloys as Structural Materials

I do not consider it at all beyond the realms of possibility that bridges and general structural work throughout the engineering fields will sooner or later be built from one or other of these types of alloys. This would have been done before were it not for the price, for these alloys have added strength over ordinary material; they are considerably more resistant in many cases to fatigue, etc., but the obstacle of price has been a barrier so high that only in exceptional cases has the increased price been considered warranted.

The price of these alloys is, of course, directly controlled by the price of chromium and nickel, and it is to be hoped that an increasing demand will bring about a substantial reduction in the price of chromium, which in turn will be reflected in the price of the finished product. There have, of course, been repeated efforts to produce some of these alloys by using chrome ore in its original condition and, while claims have been made in certain instances as to the success of this process, it has not yet found general favor.

Should it be possible in the future to bring down the price of these alloys within reasonable limits I have not the slightest doubt that the alloys themselves will rank among the highest tonnage propositions in the steel industry. Further, I believe that factors of safety, increased strength with reduction of weight, permanence without constant replacing or preservation by painting, etc., will, of themselves, demand the use of one type or another of these alloys much sooner than many people expect.

Steel Earnings Show Three-Year Cycle

Net Profits Are Better Index of Industry Than Output—Acceleration in 1929 May Reflect Overproduction of Consumer Goods

BY W. W. HAY

THE year just closed witnessed the rise of iron and steel production to new high levels. Some of the unprecedented increase was the continuation of healthy growth, but a part was undoubtedly a result of overproduction by manufacturing consumers of steel.

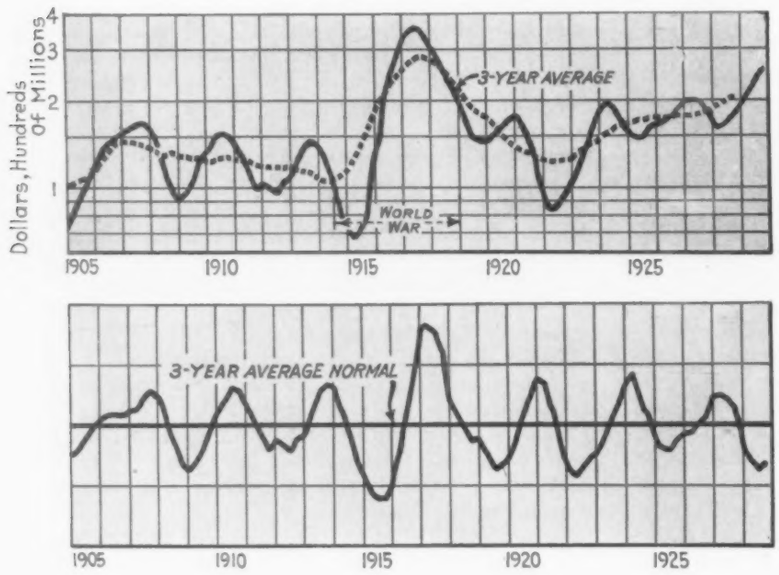
During the last half of the year the demand for steel underwent a change, and the sudden cessation of automobile production was reflected by the severe decline of steel output during November. How much of this rapid drop in steel shipments was the result of overproduction and how much was the result of the abrupt commencement of a period of business contraction cannot yet be determined, nor will the answer be forthcoming for many months.

Iron and steel form a conglomerate industry for which there exists no true index of production. The character of output is constantly being changed by varying uses within the industry, such as substitution of more scrap for pig iron or by the changing economies of sheets or strip. Moreover, improved methods have increased production at reduced cost. Nevertheless, all of the many phases of steel output have some reflection in the earnings of producing corporations.

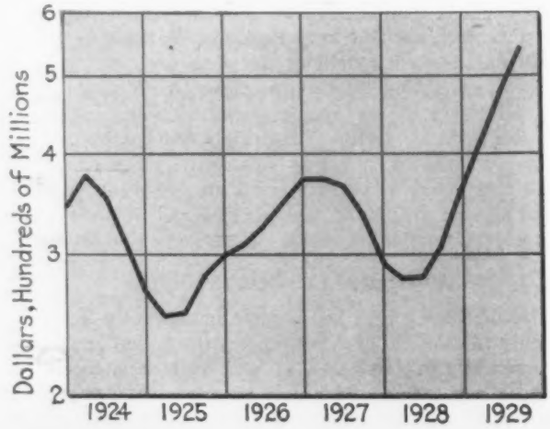
Earnings Best Index of Industry

The lengthy record of net earnings* of the United States Steel Corporation is the best indicator of the general movements of the industry. When represented by a line of 12 months' earnings plotted on the end of each quarter, yearly earnings are shown not only for the calendar year, but also for the intermediate "years" ended March 31, June 30, and Sept. 30. To all intents and for our purposes, the line joining these points of intermediate year-end earnings represents the relative changes in 12 months' production of all classes of iron and steel combined.

Inspection of the peaks and valleys of the figure shows a somewhat regular movement of one year to climb out of a bottom and two years to recede from a peak—a three-year cycle. The oscillations of the line about the current trend, represented by the three-year average, develop a very clear picture of the cycles of expansion and contraction experienced by the industry during the quarter-century for which the data are available. When similarly treated, the statistics of all phases of the iron and steel industry bear some relation to this curve. At different times the relation to this curve of some group, as pig iron or ingots, is marked, and for a period of



IN Upper Graph, at Left, the Solid Line Represents 12 Months' Net Earnings of the United States Steel Corporation Plotted on the End of Each Quarter to Take Out Seasonal Variation. Dotted line shows three-year average. In lower graph, at left, the trend line is straightened out so that earnings cycles show up more clearly. Graph at lower right shows combined net earnings of the Steel Corporation and 12 other steel companies



*Net earnings before depreciation and depletion reserves, sinking funds, bond interest, etc.

time the curves may be almost identical. Demand, represented by orders booked, is not coincident, and the lag of earnings is about six months after bookings. The representation in this manner of yearly data and the acceptance of the three-year average as the current trend may be used in many ways and is a tool to measure and compare past records.

Overproduction of Consumer Goods

The combined earnings of the United States Steel Corporation and 12 other companies are a better composite measure of iron and steel in recent years. The long-time growth apparent here kept pace with other industry until early in 1929, when the expansion was at a much more rapid rate. During the previous years which these data cover, the rate of increase was a little over 8 per cent per annum, or about the same pace set by industry generally. It is possible that the production of manufactured articles, of which iron and steel form the major part, were expanding during last year at a more rapid rate than did the consumption of such goods. This overproduction on the part of manufacturers of consumer goods, particularly of automobiles, seems to be responsible for record production of iron and steel during 1929.

The losses at the end of the year from the automobile industry were partly offset by increased shipments to other industries, and orders from the railroads, for building construction and for shipbuilding, will enable certain producers to continue to operate at a fair rate. Nevertheless, the constant narrowing of the automobile passenger car market and a possible slowing up of large railroad requirements are bound to have their effect on the industry.

Scrap Prices Lower in December Than for a Year

AVERAGE prices of heavy melting steel scrap at Chicago, Philadelphia and Pittsburgh, after showing great strength through the middle of the year, took a downward course after August and closed the year at the lowest figure for many months. The year began on an upward slope which carried the figures from an exceptionally low point in July, 1928, to a maximum in April, 1929. An intermediate slump through the early summer was overcome by higher figures in August, when the average reached $16.86 a gross ton. Since that time the decline has carried the figure to $14.08 for the first three weeks of December.

The year's average, however, at $16.28, is the highest since 1925, being $2 above the 1928 and 1927 averages, as shown in the table, and substantially above that for 1926.

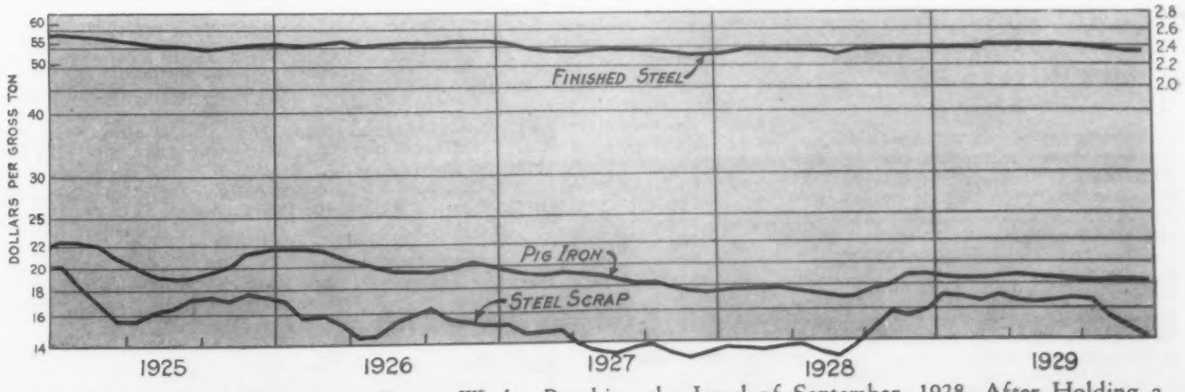
By quarters, the fourth quarter of the year, at $14.83, was much the lowest. The third quarter was $16.69; the second quarter, $16.70; the first quarter, $16.90 a ton.

Meanwhile, pig iron showed a course which was somewhat parallel to that of scrap, advancing from a low in the middle of 1928, which was the lowest since 1915, reaching a maximum in May, 1929, and declining irregularly since then to a minimum of $18.21 in the third week of December and an average of $18.32 for the last quarter of the year. The year's average of $18.43 was more than 4 per cent higher than the average for 1928, but was below the two or three preceding years, as the table shows.

Finished steel, expressed in cents a pound, showed again a similar characteristic. It advanced from 2.325c. in the middle of 1928 to a maximum of 2.412c., which was held through April, May, June and July of 1929. This was the highest figure since January, 1927. A fairly steady decline since early August brought the figure in November and December to 2.362c. The year's average of 2.393c. is the highest since 1926, but was less than 2 per cent above the averages of the two preceding years.

Comparative figures for 24 months covering steel scrap, pig iron and finished steel are given in the table. A diagram carries the story of these changing prices over a period of five years from the beginning of 1925.

	(Per Gross Ton) Steel Scrap	Pig Iron	Finished Steel, Per Lb.
1925 average	*$17.12*	*$20.58*	*2.465c.*
1926 average	*15.48*	*20.42*	*2.439c.*
1927 average	*14.00*	*18.55*	*2.357c.*
January, 1928	13.70	17.63	2.318c.
February	13.71	17.73	2.361c.
March	13.65	17.73	2.362c.
April	13.81	17.67	2.359c.
May	13.90	17.45	2.350c.
June	13.52	17.23	2.341c.
July	13.13	17.10	2.325c.
August	13.75	17.11	2.348c.
September	14.75	17.54	2.348c.
October	15.85	17.94	2.363c.
November	15.73	18.46	2.368c.
December	15.92	18.51	2.385c.
Year's average	*14.29*	*17.67*	*2.352c.*
January, 1929	17.02	18.43	2.391c.
February	16.96	18.38	2.391c.
March	16.71	18.36	2.391c.
April	17.18	18.52	2.412c.
May	16.54	18.70	2.412c.
June	16.39	18.65	2.412c.
July	16.60	18.48	2.412c.
August	16.86	18.38	2.402c.
September	16.60	18.27	2.394c.
October	15.58	18.33	2.371c.
November	14.83	18.36	2.362c.
December (three weeks)	14.08	18.26	2.362c.
Year's average	*16.28*	*18.43*	*2.393c.*



Scrap Has Gone Much Lower in Recent Weeks, Reaching the Level of September, 1928, After Holding a High Course for a Year

Merger Movement Active in 1929

Large Number of Consolidations in Metal-Working Industry with Aim of Reducing Marketing and Production Costs

LAST year, like 1928, saw the consummation of many large and important consolidations in the metal-working industries. In fact, the trend was so marked that a number of merged companies which came into existence early in the year found themselves a part of a larger consolidation before the end of the year. However, such mergers as these were usually planned in this manner, and the consolidations which led up to them are being operated as individual units of a larger holding company.

In glancing over a list of more important consolidations and acquisitions during the year, it is difficult to discern any outstanding reason for merging which might be indicative of the general trend of this development. However, the most common reason for bringing two or more companies together was undoubtedly the possibility of lower distribution costs which might be expected to result from marketing allied lines of products. About 40 per cent of the mergers completed in 1929 did bring together companies manufacturing related products that might be distributed more economically under a centralized head. A large number of concerns were brought together whose products are entirely competitive. In many of these cases it may be assumed that the object of the mergers was the achievement of economies in production costs, although here again the possibility of cheaper distribution may have been a very important factor.

Companies Buy Sources of Raw Material

ANOTHER tendency in industrial consolidations, which was possibly more marked in 1929 than in previous years, was that of bringing together manufacturers and their sources of raw material. A number of makers of railroad equipment bought out foundries during the year. The same was true of makers of machinery and heavy equipment. The object of such acquisitions was undoubtedly a desire on the part of the purchasing company to assure itself an uninterrupted flow of raw materials at a reasonable cost. In contrast to this, several companies bought out one or more of their principal customers during the year, with a view to establishing a definite backlog of orders which would enable them to keep plants operating at a more constant rate.

In looking over the industries in which mergers were most common in 1929, the iron and steel producing group stands out. During the year, 14 major consolidations or acquisitions were announced in this field, although about half of them led up to the formation of the Republic Steel Corporation, which is taking over the assets of four steel companies. As several companies now identified with this group were a part of smaller consolidations earlier in the year, not more than 20 iron and steel producing units were actually affected by consolidations during the year. The pig iron industry was characterized by three outstanding mergers or leases of individual furnaces, and in some districts greater market stability has already been realized.

Distribution Economies Aim of Some Mergers

IN the iron and steel business most of the mergers were undoubtedly planned to bring about a decrease in distribution costs. In some cases, marked production economies may be achieved, but the steel industry has already gone so far in this direction that consolidations can hardly be expected to lower manufacturing expenses very materially. In some instances, acquisitions have been prompted by the desire of large companies to extend their manufacturing facilities into new territories, and the year saw the absorption of the two leading steel manufacturers on the Pacific Coast by the country's two largest producers.

Consolidations and Acquisitions in 1929

A PARTIAL list of the most important mergers and acquisitions in the metal industries which were consummated during the year follows:

January

Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., and Niles Crane Corporation, Philadelphia, division of Niles-Bement-Pond Co., combined as Shepard-Niles Crane & Hoist Corporation, Montour Falls.

Spicer Mfg. Corporation, South Plainfield, N. J., maker of axles, frames, universal joints and other automotive equipment, buys Brown-Lipe Gear Co., Syracuse, N. Y., maker of automobile gears and transmission systems.

Cutler-Hammer, Inc., Milwaukee, unites Cutler-Hammer Mfg. Co. of New York and Milwaukee, maker of electrical equipment, and Queen City Foundry Co., Milwaukee.

Thompson Products, Inc., Cleveland, purchases Cleveland Piston & Mfg. Co., maker of finished pistons, and Cox Tool Co., producer of piston pins, Cleveland.

Witherow Steel Corporation, Pittsburgh, maker of die-rolled products, buys Dilworth, Porter & Co., Pittsburgh, manufacturers of spikes and tie plates.

New York Car Wheel Co., Buffalo, buys Brown Car Wheel Co., Buffalo.

February

Pittsburgh Screw & Bolt Corporation, Pittsburgh, is merged with Graham Bolt & Nut Co., Pittsburgh, and Colona Mfg. Co., Colona, Pa.

Jeffrey Mfg. Co., Columbus, Ohio, builder of mining machinery, conveying and handling equipment and locomotives, purchases Galion Iron Works & Mfg. Co., Galion, Ohio, maker of road machinery and equipment.

Oliver Chilled Plow Works, South Bend, Ind.; Nicholls & Shepard Co., Battle Creek, Mich., and Hart-Parr Co., Charles City, Iowa, all makers of agricultural implements, merged.

Berger Mfg. Co., Canton, Ohio, subsidiary of Central Alloy Steel Corporation, Massillon, Ohio, purchases metal furniture division of Van Dorn Iron Works Co., Cleveland.

March

Blaw-Knox Co., Pittsburgh, buys A. W. French & Co., Chicago, maker of road finishing machinery.

Surface Combustion Co., Toledo, Ohio, builder of industrial heating furnaces, acquires Webster Engineering Co., Tulsa, Okla.

Allegheny Steel Co. and West Penn

Steel Co., both of Brackenridge, Pa., consolidated to continue production of steel sheets, boiler tubes and plates.

New Britain-Gridley Machine Co., with headquarters at New Britain, Conn., formed to unite Gridley Machine Co., Hartford, Conn., and machine tool business of New Britain Machine Co.

April

Bendix Aviation Co., Chicago, formed to consolidate business of Bendix Corporation, Bendix Brake Co. and Eclipse Machine Co. and manufacture airplane accessories.

Davison Coke & Iron Co., Pittsburgh, acquires under lease the Cherry Valley blast furnace of the Hanna Furnace Co., Leetonia, Ohio, and the Claire furnace of the Reliance Coke & Furnace Co., Sharpsville, Pa.

Borg-Warner Corporation, Chicago, acquires automotive accessories business and facilities of Morse Chain Co., Ithaca, N. Y.

Minneapolis Steel & Machinery Co. and Minneapolis Threshing Machine Co., both of Minneapolis, and Moline Plow Co., Moline, Ill., consolidated to continue manufacture of farm implements and equipment.

May

Industrial-Brownhoist Corporation, Cleveland, acquires McMyler-Interstate Co., Bedford, Ohio, and will carry on building of cranes and conveying equipment.

Poor & Co., Chicago, makers of railroad equipment, absorb Rail Joint Co., New Cork, manufacturer of rail joints.

Bear Steel & Wire Co., Chicago, buys Falcon Tin Plate Co., Canton, Ohio, to remodel plant and operate as Canton Rolling Mill Co.

J. D. Wallace & Co., Chicago, and John T. Towsley Mfg. Co., Cincinnati, united to continue manufacture of woodworking machinery and factory trucks.

Century Electric Co., St. Louis, buys Roth Brothers & Co., Chicago, makers of electrical equipment.

Kennecott Copper Corporation, New York, and Chase Companies, Inc., Waterbury, Conn., are merged to continue production and distribution of brass and copper products.

Parker Rust-Proof Co. and Wolverine Enameling Co., both of Detroit, merged under name of former and will continue present activities.

Sundstrand Machine Tool Co. and Rockford Union Foundry Co., both of Rockford, Ill., are consolidated under former's name to continue manufacture of machine tools.

June

Continental Can Co., New York, acquires Federal Can Co., Nashville, Tenn., and will continue manufacture of food containers.

Curtiss Aeroplane & Motor Co., Wright Aeronautical Corporation and Keystone Aircraft Co. are consolidated under holding company to continue manufacture of aircraft and motors, as Curtiss-Wright Corporation.

July

Symington Co., Rochester, N. Y., maker of railroad equipment, is merged with National Malleable & Steel Castings Co., Cleveland, producer of railroad steel castings. Consolidation also includes Gould Coupler Co., Depew, N. Y., subsidiary of Symington Co.

Yale & Towne Mfg. Co., Stamford, Conn., buys Steubing-Cowan Co., Cincinnati, maker of hand-lift trucks.

American Pulley Co., Philadelphia, manufacturer of pulley, steel hangers and hand trucks, takes over products of Sprucolite Corporation, Bloomfield, N. J., also maker of pulleys.

Blaw-Knox Co., Pittsburgh, absorbs Union Steel Casting Co., Pittsburgh, maker of steel castings of all types.

August

Pittsburgh Steel Foundry Corporation, Pittsburgh, acquires Sharon Foundry Co., Sharon, Pa., rounding out facilities for complete line of steel castings.

General Steel Castings Corporation, Philadelphia, formed earlier in year by Baldwin Locomotive Works, Philadelphia, American Locomotive Co., New York, and American Steel Foundries, Chicago, buys Commonwealth Steel Co., Granite City, Ill.

Michiana Products Corporation, Michigan City, Ind., formed to take over Chrobaltic Tool Co., Michigan City, maker of heat and acid-resisting alloy castings, and Sheet Steel Products Co., Michigan City, manufacturer of oil filter and air cleaners.

Pittsburgh Forging Co., Coraopolis, Pa., maker of automobile and railroad forgings, takes over Riverside Forge & Machine Co., Jackson, Mich., producer of automotive forgings.

Fretz-Moon Co., Butler, Pa., maker of electrically welded steel tubing, is taken over by interests identified with Spang-Chalfant & Co., Inc., Pittsburgh, and Republic Iron & Steel Co., Youngstown.

United Aircraft & Transport Co., New York, buys Standard Steel Propeller Co., Homestead, Pa.

Lake Erie Bolt & Nut Co., Cleveland, buys American Bolt Co., Birmingham.

Stacey Engineering Co., Columbus, Ohio, formed to consolidate Stacey Brothers Gas Construction Co., Cincinnati; Connersville Blower Co., Connersville, Ind., and Wilbraham-Green Co., Pottstown, Pa., which will continue the manufacture of gas holders, blowers and other apparatus.

Superior Screw & Bolt Mfg. Co., Cleveland, takes over Federal Screw Works, Detroit.

September

Blaw-Knox Co., Pittsburgh, acquires Lewis Foundry & Machine Co., Groveton, Pa.; National Alloy Steel Co., Blawknox, Pa., and Pittsburgh Rolls Corporation, Pittsburgh.

Allis-Chalmers Mfg. Co., Milwaukee, buys La Crosse Plow Works, La Crosse, Wis., maker of farm implements.

Weirton Steel Co., Weirton, W. Va.; Great Lakes Steel Corporation, Detroit, and blast furnace and ore properties of M. A. Hanna Co., Cleveland, consolidated under holding company to be known as National Steel Corporation.

International Derrick & Equipment Co., Columbus, Ohio, buys Boykin Machine & Supply Co., Beaumont, Tex.

Globe-Wernicke Co., Cincinnati, maker of steel furniture, is merged with Unit Steel Co., Dayton, Ohio, maker of complementary line of products.

Peden Iron & Steel Co., Houston, Tex., hardware and mill supply distributer, buys E. L. Wilson Hardware Co., Beaumont, Tex.

October

Baldwin Locomotive Works, Philadelphia, takes over Southwark Foundry & Machine Co., Philadelphia.

Central Alloy Steel Corporation, Massillon, Ohio, takes over Interstate Iron & Steel Co., Chicago.

Republic Iron & Steel Co., Youngstown, acquires Union Drawn Steel Co., Beaver Falls, Pa., maker of cold-finished steel bars.

Thomson-Gibb Electric Welding Co., Lynn, Mass., is formed by consolidation of Thomson Electric Welding Co., Lynn, and Gibb Welding Machine Co., Bay City, Mich., to continue manufacture of welding machines and equipment.

Midvale Co., Nicetown, Philadelphia, acquires Chrome Alloy Products Co., Conshohocken, Pa., maker of chrome and chrome-nickel alloys.

United States Steel Corporation, New York, acquires Columbia Steel Corporation, San Francisco.

November

Joseph T. Ryerson & Son, Inc., Chicago, purchases Penn-Jersey Steel Co., Camden, N. J., steel warehouse.

Interlake Iron Co., Cleveland, is formed to take over blast furnaces of By-Products Coke Corporation, Chicago; Zenith Furnace Co., Duluth, Minn.; Toledo Furnace Co., Toledo, Ohio, and Perry Iron Co., Erie, Pa.

Lamson & Sessions Co., and Lake Erie Bolt & Nut Co., Cleveland, makers of bolts, nuts and rivets, are merged.

Donner Steel Co., Inc., Buffalo, and Witherow Steel Corporation, Pittsburgh, merged under name of former.

Oster Mfg. Co., Cleveland, and Williams Tool Corporation, Erie, Pa., both makers of pipe machinery, are merged.

December

Bethlehem Steel Corporation, New York, acquires Pacific Coast Steel Co. and its subsidiary, the Southern California Iron & Steel Co.

Corrigan-McKinney Steel Co., Cleveland, buys N. & G. Taylor Co., Philadelphia, maker of tin plate.

Eastern Metals Corporation, Philadelphia, is formed by consolidation of Carter, Donlevy & Co., Gummey McFarland & Co., and Riter Brothers & Co., all Philadelphia sheet metal distributers.

Stanley Electric Tool Co., New Britain, Conn., organized by Stanley Works, to consolidate its electrically-operated hand tool departments with Unishear Co., New York, and Ajax Electric Hammer Corporation, New York.

Wheeling Steel Corporation, Wheeling, W. Va., acquires Tyler Tube & Pipe Co., Washington, Pa.

Merger of Republic Iron & Steel Co., Youngstown; Central Alloy Steel Corporation, Massillon, Ohio; Donner Steel Co., Inc., Buffalo, and Bourne-Fuller Co., Cleveland, agreed upon.





High Lights of 1929

January

STEEL industry asks for general revision of metal schedules of Tariff Act in hearing before House Committee on Ways and Means. . . . F. W. Waterman elected president of National Tube Co., succeeding Taylor Allderdice. . . . Committees of American Society for Testing Materials urge revision of specifications on structural steel to represent more nearly plain carbon steel now being made for bridges and buildings. . . . Alan Wood Iron & Steel Co., Philadelphia, is sold to Koppers Co. and W. J. Rainey, Inc., after having been operated by succeeding generations of one family for more than 100 years. . . . Western Metal Congress and Western States Metal and Machinery Exposition at Los Angeles under sponsorship of American Society for Steel Treating and other technical organizations, gives recognition to metal industries in Western portion of country. . . . Newton Steel Co. announces plans for 12-unit sheet mill at Monroe, Mich., to supply full finished sheets to automobile trade. . . . American Society of Mechanical Engineers establishes new section in Youngstown district. . . . Harry Coulby, president Interlake Steamship Co., and prominently identified with lake ore trade, dies. . . . Iron and steel exports in 1928 at 2,862,997 gross tons were highest since abnormal period of 1920. . . . Makers of combustion furnaces organize Industrial Furnace Manufacturers Association to promote general welfare of group.

February

MERGER of American Radiator Co. and Standard Sanitary Mfg. Co., as American Radiator & Standard Sanitary Co., is approved. . . . Machinery exports in 1928, valued at $497,155,457, exceed previous record by 7½ per cent. . . . A. M. Byers Co. begins construction of plant at Ambridge, Pa., for making wrought iron under Aston process. . . . Permanent organization of representative trade associations in machinery and equipment industries is proposed at conference in Washington. . . . Manufacturers of heavy forgings and reheated products organize Forging Manufacturers Association for general cooperative activity. . . . United States Steel Corporation announces plan for retiring bonded indebtedness and increasing authorized common stock to 12,500,000 shares. . . . New card of extras adopted by cold-rolled strip steel makers results in lower net prices on extreme widths and higher quotations on very narrow sizes.

March

ROBERT P. LAMONT, president American Steel Foundries, Chicago, is appointed Secretary of Commerce. . . . Columbia Steel Corporation starts first tin mill on Pacific Coast at Pittsburg, Cal. . . . American Iron and Steel Institute files tariff brief requesting higher duties on cotton ties, wire rods, fine steels, alloy steel plates, pig iron and other products. . . . Continental Steel Entente increases annual production quota 2,000,000 tons to 31,287,000 tons. . . . Lake Superior iron ore price is advanced 25c. a ton to $4.50 for Mesabi non-Bessemer base grade after holding unchanged since 1925. . . . American mills are recognized by European Rail Makers Association, with quota of 185,000 to 190,000 tons for export.

April

COOPERATIVE advertising by steel companies to make public steel-conscious is urged by Charles F. Abbott of Steel Construction Institute. . . . Symposium on making high-test cast iron at American Foundrymen's Convention at Chicago presages beginning of new era in gray iron. . . . National Metal Exchange approves trading rules on copper futures. . . . Recently organized American Zinc Institute announces broad program of market and technical research and sales promotion to enlarge market to 1,000,000 tons yearly. . . . First shortage of semi-finished steel in Pittsburgh and Valley districts since the war hampers steel-finishing mills. . . . John Fritz Medal for "notable scientific and industrial achievement" awarded to President Hoover.

May

NEW classifications for blue annealed sheets provides two separate bases to eliminate price inconsistencies. . . . April production of commercial steel castings, at 118,986 tons, is new monthly record. . . . Philadelphia metallurgist makes plea for standard nomenclature for stain and rust-resisting steels. . . . James A. Farrell receives first award of Gary Medal for "outstanding achievement in iron and steel industry." . . . Production of 621,331 motor vehicles during April sets new monthly record. . . . Institute of Scrap Iron and Steel adopts code of business practice covering 13 common grievances. . . . G. M. Verity, president American Rolling Mill Co., urges steel industry to watch for new uses and new markets if prosperity is to be continued. . . . May pig iron output of 125,745 tons daily, with total of 3,898,082 tons, establishes new record. . . . Steel ingot production of 195,302 tons daily and total of 5,273,167 tons in May also makes record.

June

NATIONAL Association of Purchasing Agents approves adoption of decimal system for designating ages of metal products . . . First gathering of buyers and sellers of tin, sponsored by American Tin Trade Association, advocates research on pig tin . . . Interstate Commerce Commission prescribes basic mileage scale for freight rates on manufactured iron and steel products in Official Classification territory . . . Worcester Reed Warner, vice-chairman of Warner & Swasey Co., Cleveland, and pioneer machine tool builder, dies in Germany. . . . Advantageous qualities of cast iron as engineering material are outlined at symposium of American Society for Testing Materials. . . . Curtiss Aeroplane & Motor Co., Wright Aeronautical Corporation and

Metal Trades in Review



Keystone Aircraft Co., dominant interests of airplane industry, are consolidated. . . . Merger of German light sheet steel makers embraces half of country's capacity.

July

STEEL converter at Taylor-Wharton Iron & Steel Co. plant, High Bridge, N. J., makes 100,000th heat. . . . Willis L. King, vice-president Jones & Laughlin Steel Corporation, observes sixtieth anniversary of association with that company and steel industry. . . . Illinois Steel Co. announces additions of 1,500,000 tons annually to steel capacity, increasing Chicago district ingot capacity by 15 per cent. . . . Cold-finished steel bar makers adopt card of extras calculated to equalize price discrepancies long in effect.

August

FEDERAL Trade Commission announces that trade practice conferences have been held by 62 industries since Trade Practice Division was set up three years ago. . . . Recommendation of Interstate Commerce Commission calls for higher freight rates on finished iron and steel products in Western trunk line territory. . . . Machine which will automatically thread and handle 600 pieces of pipe an hour is introduced at West Allis, Wis. . . . Henry S. Pickands, of Pickands, Mather & Co., Cleveland, prominent in Lake Superior iron ore and shipping trade, dies. . . . Production of alloy steels in 1928, totaling 3,215,000 tons, was 6.2 per cent of country's total, according to survey. . . . Canadian Government plans to pay bounty on ore, thus making it independent of other countries in steel production.

September

NATIONAL Metals Exposition in Cleveland, with largest registration in recent years, reveals impressive progress in steel metallurgy. . . . Wire rope studies and research enlarged by American Society of Mechanical Engineers in effort to determine materials and methods to give longest life and safety. . . . Merger of Weirton Steel Co., Great Lakes Steel Corporation and ore and blast furnace subsidiaries of M. A. Hanna Co., is agreed upon. . . . Announce census of manufacturers for 1929 to cover industrial migration and idle power equipment. . . . Directors of American Iron and Steel Institute present Charles M. Schwab with gift commemorating his fiftieth anniversary in industry. . . . Concrete reinforcing bar industry adopts code of business practice condemning secret rebates, price discrimination and other unfair practices. . . . Engineering Foundation inaugurates program for cooperative research in iron alloys. . . . Italian steel cartel is formed embracing 95 per cent of country's production.

October

SHIPMENTS of iron and steel on Ohio River in Pittsburgh area set record in September with 150,163 net tons. . . . Unsafe practices rather than unsafe conditions cause 85 to 90 per cent of accidents in foundries, according to survey of 88 plants. . . . Holding of machine tool shows every three years and extending length is recommended by dealers following annual exposition in Cleveland. . . . Merger of Central Alloy Steel Corporation with Interstate Iron & Steel Co. is announced. . . . Expansion program of Illinois Steel Co. increased to 2,500,000 tons. . . . Completion of Ohio River canalization from Pittsburgh to Cairo, Ill., provides for a 9-ft. stage at all times and opens way for increased steel shipments. . . . Steel for 71-story Bank of Manhattan Building in New York is fabricated and erected in less than four months. . . . T. M. Girdler leaves presidency of Jones & Laughlin Steel Corporation to become associated with Eaton-Mather interests in Cleveland. . . . Two-motor direct drive for rolling mill, replacing conventional pinion drive is announced by Westinghouse Electric & Mfg. Co. for new Illinois Steel Co. blooming mill. . . . Republic Iron & Steel Co. acquires Union Drawn Steel Co., largest maker of cold-finished steel bars.

November

UNITED States Steel Corporation buys Columbia Steel Corporation, San Francisco, thus inaugurating manufacturing operations on Pacific Coast. . . . Sharp declines in stock market values bring sudden curtailment of steel buying. . . . Structural steel fabricators, at trade practice conference, adopt business code condemning unfair practices in industry. . . . Plans are completed for manufacturer census to be taken in 1930 in conjunction with decennial census. . . . Merger of Donner Steel Co. and Witherow Steel Co., Pittsburgh, is announced. . . . European steel mills plan formation of large export sales organization for International Steel Cartel. . . . Average hourly wages in iron and steel industry increased from 63.7c. in 1926 to 67.4c. in 1929, while number of employees decreased in most departments, according to Department of Labor.

December

BETHLEHEM Steel Corporation acquires Pacific Coast Steel Co. and Southern California Iron & Steel Co. . . . Youngstown Sheet & Tube Co. announces elevation of James A. Campbell to chairmanship of board and election of Frank Purnell as president. . . . Trade school for trading foundry apprentices formally opened at Cleveland. . . . Steel industry has authorized and definitely planned expenditures of $500,000,000 for plant expansion and improvements in next three years, according to announcement by James A. Farrell. . . . Water shipments of Lake Superior ore during 1929 totaled 65,204,600 tons, exceeding previous record by 500,000 tons. . . . Consolidation of Republic Iron & Steel Co., Central Alloy Steel Corporation, Donner Steel Co. and Bourne-Fuller Co., is agreed upon, forming industry's third largest company with ingot capacity of 4,900,000 tons. . . .

Outlook for Copper Excellent

Record for 1929 an Enviable One—Several Large Mergers Organized—Productive Activity Commensurate with Needs

BY EDWARD MOSEHAUER*

THE year just passed opened auspiciously for the copper industry. Despite increasing production, the insistent demand could not be satisfied without drawing upon stocks of refined copper; as a result, in March there remained a scant ten days' supply. It is not a simple matter to increase or curtail production, consequently, refinery production at the increased rate continued, although shipments had passed the peak in March.

From April to August stocks increased, a welcome development, as producers and consumers realized the danger of a shortage if disaster forced a shut-down of a single refinery.

The state of the industry was highly satisfactory late in August and all the usual practices of merchandising and the psychology of selling warranted an advance in price. The likelihood of an advance in price stimulated business and fabricators garnered sufficient orders to keep their mills operating at capacity for several months. For the ten months ended Oct. 31, production of refined copper exceeded shipments by only 23,000 tons and stocks of refined copper represented half a month's requirements.

The stock market crash in October interrupted confidence in a continuance of business activity. The record of the copper industry for the year, therefore, shows its best results for the 10-month period, although the entire year passes into history with an enviable record of progress and achievement.

Prices Closely Followed Output

THE price trend for the year follows closely the course of the aforementioned events. Beginning in January at 16¾c. per lb., the price advanced in orderly fashion to 19c. late in February. Then a combination of circumstances, including fear of a shortage, enforced withdrawal from the market of the custom smelters, and buying to beat anticipated price advances accounted for a regrettable series of rapid price advances that culminated in a short-lived quotation of 24c. per lb. in the latter part of March. During April the inevitable readjustment took place and the price settled at the 18c.-level. There it remained for the remainder of the year.

Although published statistics for 11 months show a decline in exports, consumption abroad has been maintained. Latest available statistics show an increase in the average monthly imports of refined copper by Great Britain and France during 1929 when compared with the 1928 monthly averages. Germany shows a decline which is accounted for by increase in imports of ores and matte which were refined in that country. The same comparison, applied to other countries, including Sweden, shows increased consumption.

Disturbed political conditions and financial worries caused by a shortage of capital available for industrial purposes retarded progress in Germany. Operation of the Young Plan beginning in 1930 should expedite her recovery.

France has rehabilitated her financial position and conditions are favorable for a resumption of copper buying because French plants, although bare of stocks, have orders for months in advance and buyers are awaiting assurance that no lower prices are contemplated. England manages in the traditional manner to overcome her many difficulties.

A Thoroughly Organized Industry

THE industry is better organized than at any time in its history, for advantageous disposition of the resources under its control.

Copper Exporters, Inc., affords the mechanism for operation in foreign markets. The Copper Institute gathers and disseminates statistics which keep the industry advised of the rate of production and the disposition thereof. The American Bureau of Metal Statistics continues to retain a position of importance, its compilation of metal statistics being available to all branches of the industry and to the press for publication. The Copper and Brass Research Association has completed another year of fruitful activity.

Some Large Mergers Accomplished

The acquisition of the Chase Companies of Connecticut, one of the country's foremost brass and tube mills, by the Kennecott Mining Co., marked the entry of the latter into the manufacturing field.

The Anaconda Wire & Cable Co., was incorporated during the year and included in its organization wire mills of the American Brass Co., at Kenosha, Wis., and Hastings, N. Y., and the rolling and wire mills of the Anaconda Copper Mining Co. at Great Falls, Mont. In addition, the following companies were absorbed:

Inland Wire & Cable Co., a combination of the Chicago Insulated Wire & Cable Co. and the Illinois Wire & Cable Co.; Maring Wire Co. of Muskegon, Mich., and Anderson, Ind.; Tubular Woven Fabric Co. of Pawtucket, R. I., and Marion Insulated Wire & Rubber Co. of Marion, Ind.

The Scovill Mfg. Co., Waterbury, Conn., has called a meeting of its stockholders to authorize the issue of $25,000,000 of 5½ per cent 15-yr. convertible bonds, proceeds to be used to acquire certain properties. It is presumed the company is continuing its program of expansion and intends to purchase the plants of some of its customers or competitors in its particular field.

Forecasts for 1930

FORECASTS of the automobile industry do not indicate a recession that will materially reduce consumption of copper in that field which, in 1929, amounted to 150,000 tons.

Makers of power cables are assured of good business. The electrical manufacturing companies evince no fear, as with huge projects planned and those already under way, labor is assured of continued employment, a vast buying power will be sustained, and thus a market for their products provided.

Deferred buying, accentuated by the inventory period,

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resulted in increased stocks and for that reason caused some apprehension regarding the continuance of the present price level; but, in my opinion, that sentiment is being superseded by faith in the ability of the producers to so conduct their operations that no fears need be entertained and that they will succeed in their constructive efforts to keep productive activity commensurate with the needs of the industry.

Stocks of metal in fabricators' plants are at a minimum here and abroad, so that as confidence is restored and buying resumed, there will be a demand in excess of the present rate of production.

Tin in a Period of Adjustment

Stocks Are Abnormal—Prices May Go Lower—World Consumption Will Expand—Stabilization Plans Fail

BY PAUL LINZ*

TO review the happenings in the tin world during the past year is to place before the reader a picture of statistical deterioration accompanied by declining prices. Starting early in January with a spot New York Straits price of 49.87½c. per lb., a low of 38.25c. was reached in December.

Ordinarily it is helpful to set down the statistical changes as compared to price fluctuations, but during the past 15 months the visible supply has been substantially altered from month to month by movements of tin in or out of unofficial warehouses both in this country and in Europe. A close checking up of these movements, which would enable one to include the unofficial stocks in the visible supply, would probably disclose an increase during practically every month of the current year—and this in the face of a spectacular increase in American consumption during the first half of the year.

That the price did not decline in a manner directly corresponding to the supply increase may be partly attributed to the influence which even statistics, known to be inaccurate, play but probably more largely to the nervousness of operators and consumers as a result of constantly recurring reports of stabilization agreements between producers. Subsequent events have proved these reports to be all without foundation, with the result that now each additional report becomes a signal for a further decline in price.

The cry of "wolf" has been so often repeated that an actual constructive agreement among producers might catch others vitally interested in the industry completely off their guard. It may be well, therefore, to look carefully at what has been accomplished by the advocates of "rationalization" and at what still lies ahead.

Two Viewpoints—Mines and Smelters

The industry must be looked at from two phases: (1) Mines and (2) smelters.

Mines.—There were, to start with, hundreds of independent mines headed by such large producers as the Patino Mines, the Billeton Co. and the Dutch Government (producing in the thousands of tons) scaled down to hand-labor Chinese-owned mines, some of which turn out negligible quantities. All have been faced with competition through the additional production of an ever increasing number of dredges capitalized for the most part when tin was selling at between 60c. and 70c. per lb.

In view of the complete separation of each unit from the others, the only means of defense was to reduce costs through increased mining efficiency which, being a synonym for still more production, has proved to be a boomerang. Meanwhile, in a world which no longer subscribes wholeheartedly to the doctrine of a "survival of the fittest," frantic efforts were being made to obtain some sort of industrial cooperation.

Amalgamations Increasing

One important group during this period has gradually absorbed smaller producers in Nigeria and the Federated Malay States until it now controls approximately 10 per cent of the world's production. Another amalgamation of lesser importance (but nevertheless reflecting the trend) has taken place among some of the smaller Bolivian mines. Further, a Producers' Association has been formed which, while not as yet pledged to any specific action toward regulation, has at least brought together important forces—in itself a constructive step.

Smelters.—An important feature in the industrial makeup of tin is that the smelters have (with the exception of the producers of Banka tin) been separate financial units having virtually no link with the miners, other than through contracts for the treatment of ore. Obviously, under such a structure, the interests of the smelters and the miners, during a period of overproduction, would not always be identical. The additional obstacles in the path of cooperation thus caused are too obvious to require amplification.

Within the past year or so the mining group, previously referred to, has acquired control of one of the large English smelters. More recently the largest Bolivian mining interests have taken over the largest English smelter. Now we have the announcement of an amalgamation of four smelters representing slightly less than half of the world's output based on 1929 production figures.

Immediate Outlook Clouded

Thus it will be seen that the trend toward cooperation, both through amalgamations and initial working agreements, has definitely proceeded at an increasingly rapid pace during the past year. There may still be a long road ahead but it is a road whose slope should become less steep and its surface less rough.

The immediate outlook is still further clouded by uncertainty with respect to American consumption. Stocks are abnormally large. Prices may go lower. Over a long period the world will consume more tin—not less—and the mines can only meet this increase on the basis of a fair return.

*American Metal Co., New York.

Canadian Steel Companies Expand

Dominion Industry Enjoyed Largest Business Since the War— Railroad Expansion and Building Large Factors

CANADA has had one of its most prosperous peacetime years. A high rate of production in all leading industries was maintained through the first three quarters. In the final quarter a decline in activity paralleling that in the United States was experienced. The close industrial relationship existing between the Dominion and the States was illustrated by the fact that the effects of the stock market crash were reflected in Canadian industry to a considerable degree.

Curtailed operations in the steel industry, especially the departments supplying raw materials to the automobile industry, came in the last quarter of 1929. The low crop yield in the Canadian West was directly responsible for a slowing down in the agricultural machinery industry, which dropped from full capacity operations around the middle of the year to about 35 per cent in the final months.

Much of the pronounced activity in the steel industry throughout a large part of the year was due to large building programs and the extensive buying of the two railroad systems, the Canadian Pacific and Canadian National.

Canada's Steel Industry Optimistic

While at the moment there appears to be some uncertainty as to what the future holds for Canada's steel industry, those who are directly interested in these enterprises are inclined toward optimism, which is based largely on expectations of railroad buying in good volume. The automotive and agricultural machinery industries may be slow in regaining their full stride, but even in these lines, which have been the most seriously depressed, it is believed that the slump will be of short duration.

The steel industry of Canada broke a number of records in 1929. Except for 1918, when wartime demands brought a total output of 1,622,000 gross tons of steel ingots in 1918, the steel production of 1929 was a record, at 1,254,019 tons (December estimated). The accompanying table shows the trend of production from 1923 to 1929, inclusive.

Nearly all of the Canadian steel companies engaged in programs of plant expansion and betterment during the year.

PRODUCTION OF IRON AND STEEL IN CANADA
(In Gross Tons)

Year	Pig Iron	Ferroalloys	Ingots	Castings
1923.....	880,018	28,961	839,710	45,060
1924.....	593,024	26,400	625,175	25,515
1925.....	570,397	25,709	733,855	18,840
1926.....	737,503	57,416	743,550	33,338
1927.....	709,697	56,514	867,928	39,710
1928.....	1,037,535	55,573	1,201,477	42,783
(a)1929.....	1,101,095	75,606	1,254,019	69,054

(a) Figures for December, 1929, estimated.

The Steel Co. of Canada, Ltd., Hamilton, Ont., installed two new 130-ton open-hearth furnaces and two bar mills, one 10 in. and the other 12 in. Its ingot capacity was increased by 200,000 tons a year. A few months ago the company announced plans for the erection of a galvanized wire plant to cost $500,000. Work on this will be done this year. A new ore dock is under construction.

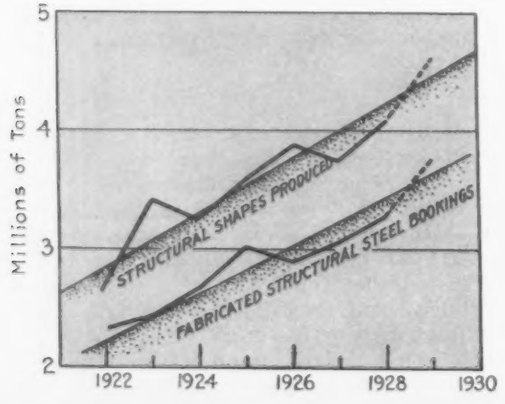
The Algoma Steel Corporation, Sault Ste. Marie, Ont., entered into a construction program to cost about $2,500,000. This included the rebuilding of the 12-in. and 18-in. bar mills, which will increase their capacity by about 50,000 tons a year.

The Dominion Iron & Steel Co., Sydney, N. S., expended about $500,000 in replacements.

The Canadian Steel Corporation, Ojibway, Ont., removed a wire plant from Hamilton, Ont., and this is now in operation at the Ojibway works. According to a recent announcement by Ward B. Perley, president, plans are being prepared for the installation of a tin plate mill at Ojibway to cost $1,500,000. The company also intends to provide equipment for the rolling of black sheets.

Record Year in Building

As 1929 was a record year in the construction of buildings and bridges in Canada, steel fabricating plants added to their facilities. The Dominion Bridge Co. increased the capacity of its plants in Toronto and Montreal, established plants in two or three Western cities and has started work on a new fabricating plant at Vancouver, B. C., to cost $1,500,000. The Hamilton Bridge Co. and some of the smaller fabricating shops expanded.



Consumption of Structural Steel

CONSUMPTION of fabricated steel at the present time appears to be increasing at a rate of 5½ per cent per annum. The trend line, as drawn on the accompanying chart, indicates that any one month should show somewhat over 200,000 tons more going into use than for the corresponding month of the preceding year. On this basis, an absorption of 3,750,000 tons would represent 1929's normal needs and 3,950,000 tons those of 1930, and so on until a new rate of expansion has been brought about. The zigzag line represents, of course, the actual bookings of fabricated steel.

Meanwhile, the output of structural shapes is at a rate of increase of 227,000 tons per annum, corresponding of today's total tonnages to 5 per cent. The normal indicated needs for 1930 are 4,675,000 tons.



Ohio River Shipments Gain

Pittsburgh District Has Taken Advantage of Waterways Improvements—Other Canalization Projects

RIVER movement of iron and steel products during 1929 received considerable impetus from the completion of the Ohio River canalization project which definitely assured a 9-ft. stage from Pittsburgh to the Mississippi over the entire year. The completion of the last dam on this program brought to a close a movement which had been extended over a 50-yr. period and which had cost $200,000,000. It established the Ohio River as one of the definite links in the country's transportation system, and the ceremonies attending the completion of the project were of such a national import that water transportation throughout the entire country was given marked acceleration.

In the Pittsburgh district alone many old projects were revived and new ones originated and the end of the year found many communities in western Pennsylvania and northeastern Ohio which produce a large tonnage of steel seeking a water outlet to the Gulf of Mexico and the consuming district on the lower Ohio and Mississippi Rivers.

Canalization Projects Proposed

Refusal by the Interstate Commerce Commission of the request of the Pittsburgh, Lisbon & Western Railroad to construct a rail link to connect the Youngstown district with the Ohio River has given Valley steel mills added interest in the canalization of the Beaver, Mahoning and Shenango rivers, thus giving Youngstown and nearby cities direct water outlet to the river. This plan, however, is opposed by Pittsburgh shippers, who would not favor any canalization project to the north which does not give their shippers water access to Lake Erie. Under these circumstances improvement of rivers in the Youngstown district may be expected to move slowly on account of the resultant competition with the Pittsburgh area.

In the meantime the approaching completion of the existing project on the Allegheny River has led to requests on the part of shippers in that territory for further improvement of this stream and authorization may be given by the present Congress for the construction of two additional locks and dams which would make this river navigable as far as Oil City, Pa. The present project provides slack water as far as Riverton, Pa., and the additional locks asked for would extend navigation to East Brady, Pa., a distance of 71 miles above Pittsburgh.

Another project which is also receiving considerable attention at this time is a river outlet for Johnstown, Pa., which would be made possible by the canalization of the Conemaugh and Kiskiminetas rivers. At present steel from the Cambria works of the Bethlehem Steel Co. is moved by rail to Glassport, Pa., where transfer by barge may be made, and the Bethlehem company has been taking advantage of this combined rail and water service in recent years. The Conemaugh-Kiskiminetas improvement is receiving considerable impetus at this time and developments are being watched with interest by Pittsburgh steel shippers.

Pittsburgh Shipments by Water Gain

Shipments of steel by water from the Pittsburgh district continued to gain in 1929 and improved navigation conditions on the Ohio River had their effect in bettering the service. During the year the Jones & Laughlin Steel Corporation added 12 barges to its large fleet for down-river use and has two towboats under construction. The Carnegie Steel Co. added one towboat, while the various private water transportation companies operating out of the Pittsburgh district made numerous additions to their facilities. The Davison Coke & Iron Co. ordered 20 barges for its subsidiary, the Basic Barge Line, Inc., for the transportation of cement and other products.

As in previous years the Carnegie Steel Co., also operating in behalf of the other Steel Corporation subsidiaries, led all other companies in the tonnage of steel shipped out of the Pittsburgh district by water. It dispatched 50 tows of steel products to points on the Ohio and Mississippi rivers, with a fair percentage going as far as New Orleans. The Jones & Laughlin Steel Corporation also shipped a large tonnage by water and an important addition to its Memphis, Tenn., warehouse indicates the growing importance of this company's business down the

river. The Pittsburgh Steel Co., the Wheeling Steel Corporation and Spang, Chalfant & Co. also participated in river trade during the year, and other steel companies utilized barge service for delivery of raw materials. The blowing in of the Neville Island blast furnace of the Davison Coke & Iron Co. led to heavier shipments of pig iron on the rivers and heavy tonnages of basic iron moved from this plant to at least one steel company farther down the river.

Total tonnage of iron and steel products handled on the Allegheny, Monongahela and Ohio rivers, within the jurisdiction of the Pittsburgh office of the United States Corps of Engineers, for the 11 months ended Nov. 30, 1929, was 2,279,904 tons. This compared with 2,262,126 tons in the corresponding period of 1928. Of the 1929 tonnage, Allegheny contributed 2107 tons, the Monongahela 1,142,770 tons, and the Ohio as far south as Wellsburg, W. Va., 1,135,027 tons. These figures are for both up and down-river shipments and include a large tonnage of interplant shipments.

The Steel Corporation utilizes the rivers for large shipments among its various plants in the district, and the Jones & Laughlin company moves sizable tonnages between its plants in Pittsburgh and Aliquippa, Pa. River shipments, of course, were influenced by the sharp decline in steel production during the last two months of the year, and it is safe to assume that 1929 movement would have been considerably higher if the steel demand had not decreased sharply in the last quarter. September shipments of 150,163 tons on the Ohio River in the Pittsburgh district set a new monthly record, and a large percentage of steel reaching the Ohio is destined for points on the lower part of the river and the Mississippi. It is estimated that well over 300,000 tons of finished steel products was shipped from the Pittsburgh district to points between Cincinnati and the Gulf in 1929 and by some the total is estimated at as high as 400,000 tons.

Railroad Equipment Buying Gains

(*Concluded from page* 21)

equipment. Including the inquiries of the Van Sweringen roads, car builders foresee a total of at least 25,000 or 30,000 cars to be purchased during the first quarter of the year.

As nearly as can now be estimated, the total car purchases for 1930 are expected to approximate those of 1929. Some years ago the American Railway Car Institute and individual car-building companies estimated that growth in population and in traffic demands, obsolescence of equipment and other factors would necessitate a much larger buying program than this, but in the past year or two such estimates have been considerably revised in the light of developments in railroad operating efficiency with the present amount of rolling stock. Present estimates, believed by the car-building industry to be conservative, are that the railroads will buy about 100,000 cars each year during the next five years.

A year-end statement given out by R. H. Aishton, president American Railway Association, estimates that the 1930 budgets of the railroads will call for capital expenditures of $1,050,000,000, as compared with $800,000,000 in 1929, which in turn was an increase of $123,000,000 over 1928 and $28,450,000 over 1927.

Of the 1930 capital expenditures, $680,000,000 will be for roadway and structures and $370,000,000 for new equipment. It is estimated that the first six months of 1930 will absorb $490,000,000, or an increase of $140,000,000 over the expenditures for similar purposes in the first half of 1929.

Freight traffic was in greater volume in 1929 than in any previous year except 1926, when there was an extraordinary movement of coal for export owing to the strike of British coal miners. However, the 1926 traffic exceeded that of the past year by only six-tenths of 1 per cent. A preliminary compilation of loadings of revenue freight, announced by the American Railway Association, gives a total of 52,798,000 cars for the year, or 300,819 cars less than were loaded in 1926.

"Measured in net ton miles, however," says the report, "the volume of freight handled in 1929 will be, complete reports are expected to show, the greatest for any year, amounting to more than 490 billion net ton miles, an increase of 1 per cent over 1926, the highest previous year. The fact that the total net ton miles was greater in 1929 than in 1926, while loadings were slightly less, is due to the increase that has taken place during the past year in the average length of haul, resulting from the fact that railroad freight traffic consists to a larger extent of goods in bulk moving longer distances."

Equipment Decreases, Operating Efficiency Increases

THE railroads in 1929 installed in service 85,000 freight cars and 780 locomotives, compared with 58,395 freight cars and 1390 locomotives in 1928. Ownership of freight cars by Class I railroads on Dec. 1, 1929, was approximately 2,266,000 cars, or 1.5 per cent less than on Dec. 1, 1923, while the average carrying capacity per car owned increased 2.7 tons per car, or 6.3 per cent. The number of locomotives owned by Class I railroads on Dec. 1 was 57,350, a decrease of 7240 locomotives, or 11.2 per cent, compared with the same date in 1923, but the average tractive power increased over 14 per cent.

Outlook in Drop Forgings *

THE year 1929 taken as a whole, because of extreme activity during the first nine months, has been a better year for the drop-forging industry than any of its immediate predecessors. Demand has been such as to enable the rank and file of the industry to secure a slightly better scale of prices than has usually been the case, but it is doubtful if the average return to most of the companies, even in 1929, has been equal to the normal return of many other industries. This is to say that competitive conditions, lack of internal information and the concentrated purchasing power of the industry's principal customers are such as to keep those of the industry who depend upon volume for their result constantly contending with each other for what most other industries would regard as sub-normal profits.

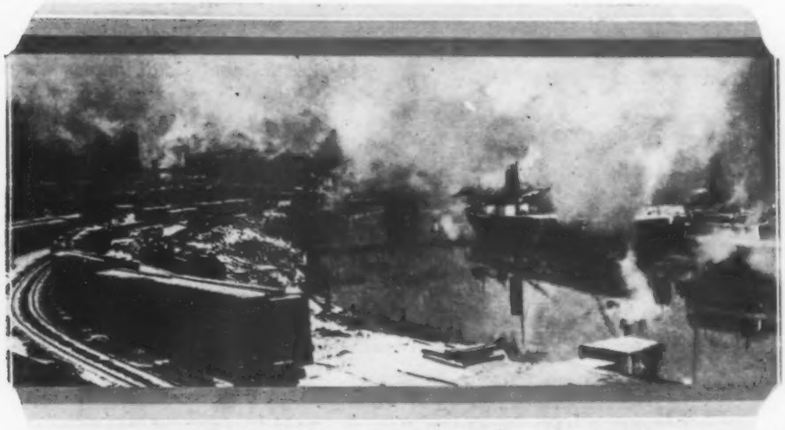
With the falling off in demand since decline of the security markets and automotive production early in September, these conditions have naturally become much more marked. They bid fair to remain so until such time as the industry becomes sufficiently integrated to base prices not upon what the customer wishes to pay but upon the cost of efficient production plus a profit considerably better than the coupon of a bond as a proper compensation for the risks and hazards that are peculiarly applicable to the machinery and tools employed in this business.

The year 1930 would appear at this early writing to offer a fairly satisfactory volume, although probably less than the year just ended. It will yield a profit only for those who will be satisfied to accept a reduction in the previous volume for the sake of showing a profit on what they do undertake. Since no year in this business "hits on all twelve," it is likely that the latter half or three quarters of the year will have to make up for the slow start in the first quarter.

*As viewed by J. Harvey Williams, president, J. H. Williams & Co., Buffalo.

Records in Steel-Making Capacity

Eleven New Open-Hearths Add 1,005,000 Tons, Largest Since War—Expansion of 47 Furnaces This Year—Small Pig Iron Increase



OPEN-HEARTH furnace projects were a notable feature of 1929. Not only was the additional annual capacity completed last year the largest since the war but projected work for construction this year makes for a total beyond anything done in the war years. What was added in the year to existing facilities amounts to 1,005,000 gross tons. What is now definitely planned for 1930 will expand the total by 4,690,000 tons.

A summary of the important facts regarding new construction and equipment in 1929 or planned for 1930, furnished by companies having blast furnaces, steel plants and rolling mills as well as foundries, follows:

Open-Hearth Capacity Added Last Year Exceeds Million Tons

A year ago nine furnaces were planned for completion in 1929. Our reports show that 11 furnaces were built having a steel-making capacity of 1,005,000 tons. This compares with 895,000 tons for 12 furnaces in 1928, the previous post-war record. The war peak was 4,205,000 tons for 103 furnaces in 1916.

Additions to open-hearth capacity in 1929 were made by the following companies:

Interstate Iron & Steel Co., Chicago, one 100-ton furnace; Youngstown Sheet & Tube Co., Indiana Harbor plant, Chicago, three 250-ton furnaces; Ford Motor Co., Detroit, three 100-ton furnaces; Laclede Steel Co., Alton, Ill., one 100-ton furnace; Continental Steel Corporation, Kokomo, Ind., one 100-ton furnace; Sheffield Steel Corporation, Kansas City, Mo., one 100-ton furnace, and Inland Steel Co., Chicago, one 100-ton furnace.

Large Increased Capacity for 1930

Present plans call for the building of 47 open-hearth furnaces in 1930, the largest increase since the war. Estimated capacity of the 47 furnaces is 4,690,000 tons.

The projected expansion is reported by the following companies:

Bethlehem Steel Corporation, Lackawanna plant, six 150-ton furnaces and six 150-ton furnaces at its Maryland plant; Empire Steel Corporation, Mansfield, Ohio, two 100-ton furnaces; Great Lakes Steel Corporation, Detroit, six 150-ton furnaces, and General Steel Castings Corporation, Eddystone, Pa., three 50-ton furnaces.

The United States Steel Corporation announces plan for the erection of 14 furnaces at the South Chicago Works and seven furnaces at the Gary Works of the Illinois Steel Co. at Chicago, but does not state the size of the furnaces. A 3-furnace duplex open-hearth plant is scheduled for the National Works of the National Tube Co. at McKeesport, Pa., the size or capacity of operating units not reported.

Rebuilding and enlarging of existing open-hearth furnaces have been indulged in by several companies. Besides the Steel Corporation and the Bethlehem company, which have rebuilt or are rebuilding a number of furnaces, the Weirton Steel Co. is increasing the capacity of five of its 175-ton units to 250 tons and the Heppenstall Forge &

Additions to Open-Hearth Capacity Since the War

Year	Annual Capacity, Gross Tons	Year	Annual Capacity, Gross Tons
1920	675,000	1925	585,000
1921	247,500	1926	865,000
1922	227,500	1927	630,000
1923	875,000	1928	895,000
1924	375,000	1929	1,005,000

Increase in Open-Hearth Furnaces and Capacity in Gross Tons

	Furnaces	Capacity
Completed in 1929:		
Independent companies	11	1,005,000
United States Steel Corporation	..	.....
Total	11	1,005,000
Projected for 1930:		
Independent companies	23	1,830,000
United States Steel Corporation	24	2,860,000
Total	47	4,690,000

Knife Co. is expanding its two 18-ton furnaces to make 25 tons each.

Only One New Blast Furnace Last Year

The only new blast furnace added to the country's capacity in 1929 was that of the Globe Iron Co., Jackson, Ohio. This is a 300 to 500-ton furnace, depending on character of output, having an average yearly capacity of about 145,000 tons. In three other years since the war only one new furnace was blown in—in 1921, in 1924 and in 1925. In 1923 and in 1927 no new furnaces were added. The largest years since the war have been 1920 and 1926, when six furnaces were completed each year having a capacity of 875,000 tons and 1,255,000 respectively.

Since the war the record of blast furnace additions has been: Two in 1919; six in 1920; one in 1921; two in 1922; none in 1923; one in 1924; one in 1925; six in 1926; none in 1927; two in 1928, and one in 1929—22 in all. The record for any peace year was nine new stacks in 1912, with the war record at 14 in 1917.

Blast Furnace Expansion in 1930

Two furnaces are reported as under construction for possible completion this year. One is the 1000-ton furnace of the Federal Furnace Co., South Chicago, Ill., and the other a 600-ton stack for the Wisconsin Steel Co., Chicago. The estimated capacity of these two furnaces is about 590,000 tons per year.

Increased capacity due to the rebuilding and enlargement of existing blast furnaces is an important factor. During 1930 the Weirton Steel Co. will enlarge its No. 1 furnace from 700 tons to 1100 tons per day, and the Wheeling Steel Corporation will complete the rebuilding of its No. 1 La Belle furnace from 450 to 800 tons. The Hanna Furnace Co. plans to increase the capacity of its "A" furnace at Detroit to 1000 tons per day. At least three furnaces of the Bethlehem Steel Corporation have been enlarged or are in process of enlargement. A new stack was built last year in place of the "B" furnace at its Maryland plant and the present "C" stack will be replaced this year. At the company's Cambria plant a new furnace to replace the present "G" stack is planned.

Four blast furnaces at the various plants of the Carnegie Steel Co. and three at some of the plants of the Illinois Steel Co. have either been rebuilt or remodeled or are to be this year.

New Electric Steel Capacity

No detailed analysis of increased capacity due to installations of electric furnaces is made. Several new electric furnace installations are reported by leading steel companies. Two large companies which produce the high-chromium and chromium-nickel ("18 and 8") rustless steels announce plans for enlarged electric capacity, one now installing a 25-ton furnace. Total new installations in the country are estimated to approximate about 40 units of various sizes.

The chief features of the reports to THE IRON AGE of the various companies covering new construction, completed or planned, follow:

Plans of the Steel Companies

The Steel Corporation

NEW construction completed during 1929 and under way as of Jan. 1, 1930, by subsidiary manufacturing companies of the United States Steel Corporation are as follows:

Carnegie Steel Co.

Completed

Edgar Thomson Works: Modernizing blast furnace "I" and hot blast stoves, new turboblower and additions to stock yard storage and handling facilities; 5 open-hearth furnaces rebuilt.

Duquesne Works: New central boiler plant at blast furnaces, and improvements to blast furnaces Nos. 1, 2, 3 and 4.

Homestead Works: Blacksmith and welding shop, and additions to shearing and shipping facilities at 110-in. plate mill.

Ohio Works: Blast Furnace No. 2 rebuilt.

Mingo Works: A 1500-ton hot metal mixer with building extended, and hot metal handling equipment modernized.

McDonald Mills: A 10-in. continuous hoop mill and slack barrel hoop shop.

Clairton Works: Rebuilding blast furnace No. 1, including new gas washer and improvements to stock house facilities; four 125-ton ladle cranes for open-hearth plant.

Under Way

Edgar Thomson Works: Rebuilding blast furnace "D."

Homestead Works: Extending stock yard and making additions to crane facilities at No. 4 open-hearth plant.

Mingo Works: Two turboblowers for blast furnaces.

Upper Union, Youngstown, Works: Central assembling and shipping buildings; also increasing rolling capacity of 12-in. bar mill No. 6.

McDonald Mills: New 10-in. bar mill No. 17.

Clairton Works: Compressor station and gas line at by-product coke plant, and improvements to ore yard, including new ore bridge and transfer cars.

Farrell Works: Additions to blooming and sheet bar mills.

Illinois Steel Co.

Completed

South Works: Remodeling 8 hot blast stoves at blast furnaces Nos. 5 and 6; one 1300-ton hot metal mixer at No. 3 open-hearth plant; two 6000-kw. gas engine-driven electric generating unit additions to No. 1 power station, and equipping north end structural mills with electric drives, replacing steam power.

Joliet Works: Additions to blast furnace No. 3 and hot blast stoves and improvements in by-products recovery departments at coke oven plant.

Gary Works: Rebuilding blast furnace No. 11 and enlarging four hot blast stoves, and equipment for hot coiling, cooling and shearing strip steel at 12 in. and 20 in. strip mills.

Under Way

South Works: Rebuilding blast furnace No. 8; adding five gas-driven blowing engine units to modernize and improve blowing facilities at blast furnaces Nos. 1 to 10 and "E"; new blowing station of three centrifugal blowers at Bessemer department, and building a 14-furnace open-hearth plant. A flue dust sintering plant, wide flange beam mill and a new roll shop and consolidating roll turning facilities are also under way.

Joliet Works: Flue dust sintering plant at blast furnaces.

Gary Works: Rebuilding blast furnace No. 10; the addition of a 7-furnace open-hearth plant; 28-in. mill for rolling strip steel, and two additional batteries of 69 ovens each at by-product coke plant.

Canadian Steel Corporation, Ltd.

Completed

Ojibway Works: Plant for wire drawing, galvanizing and fence department.

Under Way

Ojibway Works: Plant for galvanizing sheets and tinning black plate.

National Tube Co.

Completed

National Works: New roll stands and electric drive for finishing end of 13-in. continuous skelp mill.

Lorain Works: Improvements to blast furnace No. 5.

Gary Works: Expanding mill with reheating furnace and auxiliary equipment for manufacturing seamless pipe up to and including 24 in. outside diameter.

Under Way

National Works: A 3-furnace duplex open-hearth plant and auxiliaries, changes and additions to blooming and slabbing mills, including new 32-in. reversing bar mill and Nos. 1 and 2 seamless pipe mills.

Lorain Works: New seamless mill No. 3, replacing lap weld mill No. 6.

Gary Works: Additional equipment in No. 1 seamless mill for manufacture of pipe 13 in. to 24 in. outside diameter.

American Steel & Wire Co.

Completed

Newburgh Steel Works: New cooling beds for 35-in. blooming mill.

Cuyahoga Works: New rolling mills for large rounds and narrow strips.

Allentown Works: Rebuilding cleaning house and baker.

Trenton Works: Rod storage building and handling system.

Worcester, South Works: Improved copper wire drawing and annealing equipment.

Worcester, Electric Cable Works: Additional fine wire enameling equipment.

Under Way

Central Furnaces: Additions to blast furnace "C" and enlarging four hot blast stoves; modernizing blowing facilities of two blast furnaces.

Waukegan Works: Increasing wire drawing capacity.

Rankin Works: Motor-driven wire drawing blocks to modernize equipment.

Worcester, South Works: Improved copper wire drawing and annealing equipment.

Donora Steel Works: New stock bins and improvements to ore handling system at blast furnaces, and rebuilding four open-hearth furnaces.

Donora Zinc Works: Additional ore roasting equipment, and equipment for recovery of allied metals from zinc ores and for treatment of galvanizing by-products.

American Sheet & Tin Plate Co.

Completed

Gary Sheet Works: Extension to cold rolling, annealing and hot mill buildings, new normalizing furnace and four additioal sheet furaces.

Laughlin Works: Extending boiler house, two 723-hp. boilers and auxiliary equipment and 500-kw. turbine generator.

New Castle Works: Improvement of annealing and pickling departments.

Shenango Works: Mechanical gas producer and gas burners for seven annealing furnaces.

Wood Works: Extending two normalizing furnaces and furnace buildings.

Vandergrift Works: Normalizing furnace, new warehouse building and improvements in annealing department.

Mercer Works: Additional normalizing furnace and extending warehouse.

Under Way

Gary Sheet Works: Four continuous pair furnaces and modernizing four combination furnaces.

Vandergrift Works: Additional normalizing furnace, and 47 box annealing furnaces and four mechanical gas producers.

Guernsey Works: New finishing department and warehouse buildings.

Wood Works: Facilities for manufacture of chromium sheets.

Mercer Works: Changes to hot mill pickling, annealing, cold rolling and finishing departments to roll and finish 72-in. wide material.

Farrell Works: Rebuilding tin house and rearranging equipment.

American Bridge Co.

Completed

Gary Works: Shop building and equipment for fabricating C. B. column sections.

Under Way

Ambridge Works: Shop building and equipment for fabricating C. B. column sections.

Tennessee Coal, Iron & Railroad Co.

Completed

Ensley Works: Two 1250-hp. boilers at No. 1 steam plant, and additions to shearing and loading facilities at billet mill.

Fairfield Works: A 12-in. cotton tie and hoop mill, and converting jobbing mill into two sheet mills.

Under Way

Ensley Works: Rebuilding five ladle cranes at open-hearth department, and extension to fertilizer plant.

Fairfield Works: Continuous reheating furnace and building at combination bar and structural mill, and new warehouse and extensions to finishing departments of sheet mill.

Bethlehem Steel Corporation

SUBSIDIARY companies of Bethlehem Steel Corporation report the following principal improvements and additions completed in 1929 and under way at the close of the year:

Completed

Bethlehem Plant, Bethlehem, Pa.: Four 500-lb. electric melting furnaces and equipment; extension and addition to structural fabricating shop and scrap preparation plant.

Lebanon Plant, Lebanon, Pa.: Coal storage and pulverizing plant; 5500-kw. turbogenerator and ash handling equipment at power house.

Maryland Plant, Sparrows Point, Md.: New stack to replace present "B" blast furnace stack; hot blast stove for furnace "C"; extension to mixer building at No. 1 open-hearth and extensions to warehouses at tin plate department and at pipe mills.

Lackawanna Plant, Lackawanna, N. Y.: Two-story extension to physical and testing laboratory; five Bethlehem gas-driven blowing engines with gas-washing equipment; gas washers at "F" and "G" furnaces; two ore and coal unloaders at ore dock and extension of coal storage facilities; plant for recovery of phenol at coke by-product department; three waste heat boilers and additions and improvements to mold yard at open-hearth No. 1; extension to billet yard; two additional crane runways for shipping yard; beam and column shop; vessel loading rig for outbound shipments.

Cambria Plant, Johnstown, Pa.: Water-treating plant for Franklin division; coke bin and conveyor at "K" blast furnace; soaking pit and building extension at 40-in. blooming mill, Franklin division; additional hot beds and roller run for 14-in. mill, Gautier; rail anchor plant; warehouse for rod and wire division.

Under Way

Bethlehem Plant, Bethlehem, Pa.: Six-story addition to general office building; Dwight-Lloyd type sintering plant; two Bethlehem gas-driven twin blowing engines; gas-cleaning equipment for blast furnace gas; improvements and additions to cold drawing department; addition and extension to Nos. 1 and 2 structural fabricating shops.

Steelton Plant, Steelton, Pa.: Scrap preparation plant; motorizing 20-in. bar mill; extension to structural fabricating shop.

Maryland Plant, Sparrows Point, Md.: New central dispensary; battery of 61 Koppers coke ovens replacing present No. 2 battery; new stack to replace present "C" blast furnace stack; gas cleaning and distribution system for blast furnace gas; new open-hearth No. 3 consisting of six open-hearth furnaces and auxiliary buildings and equipment; new 40-in. universal slabbing mill with eight soaking pits and auxiliary buildings and equipment; four additional hot sheet mills and auxiliaries; seven bay extension to galvanizing department at sheet mills; extension to rod storage, shipping department and warehouse at wire mills.

Lackawanna Plant, Lackawanna, N. Y.: Improvements and additions to boiler house at No. 2 power station; three Bethlehem gas-driven blowing engines with gas-cleaning equipment; central coke screening station for blast furnaces; cleaning equipment and distribution system for use of blast furnace gas at open-hearth and mills; additional gas producer for nut coke at coke ovens; four waste heat boilers at open-hearth No. 1; new No. 3 open-hearth consisting of six furnaces with buildings and equipment; continuous bloom, sheet bar and billet mill including buildings and auxiliaries; gag press, manipulator table and transfer tables at structural shipping yard.

Cambria Plant, Johnstown, Pa.: Central coke screening station; one battery of 77 Koppers coke ovens including coke bin, coke wharf and quenching station at Franklin division; two turboblowers for "G," "H" and "J" blast furnaces; gas-cleaning and distribution equipment for five blast furnaces at Franklin division and for "E" and "F" furnaces at lower division; two steam generators for blast furnaces at lower division and two for blast furnaces at Franklin division; new stack to replace present "G" blast furnace stack at Franklin division; gas fuel distribution lines for Franklin division; six 4-hole soaking pits, including building and cranes for 48-in. blooming mill, lower division.

Jones & Laughlin Steel Corporation

The Jones & Laughlin Steel Corporation, Pittsburgh, during 1929, built an extensive addition to its Memphis, Tenn., warehouse. It also added 12 steel barges to its fleet for down-river trade.

Extensive improvements to the Bessemer converter department at South Side works, Pittsburgh, are now under way, while at the North Side works installation is being made of a 15,000-hp. gas-fired boiler plant with auxiliary equipment, and of a 20,000-kw. turbogenerator.

At the Aliquippa, Pa., works, a battery of 81 Koppers-Becker by-product coke ovens, with complete by-product recovery apparatus, is under construction, as well as a 75-hp. boiler plant with accompanying equipment, and a 20,000-kw. turbogenerator and a turboblower for the blast furnace department. The company is also constructing two river tow boats.

Youngstown Sheet & Tube Co.

THE Youngstown Sheet & Tube Co., Youngstown, completed during 1929, at its various plants, the following construction work:

Campbell Works

Blast Furnace Plant: The remodeling of "A" furnace and installation of a central coke bin and McKee top with double skip.

Open-Hearth Department: The addition of a leanto, and necessary equipment for hot tops.

Tube Mills: The installation of a new heating furnace at the Pilger mill. (The entire rearrangement of the butt weld mills, at both the furnace end and the finishing end.)

Rolling Mills: The electrification of the main drives of No. 1 skelp mill, sheet bar mill, billet mill and No. 2 blooming mill, and the installation of electric door hoists on the heating furnace at No. 1 skelp mill.

Sheet Mills: Remodeling of pickling equipment.

General: New air compressors at power house and No. 2 blooming mill. Additional

machine tools in No. 1 machine shop, carpenter shop and pattern shop, and new brick office in the sheet mill.

Indiana Harbor Works

Blast Furnace: A 250-ft. extension to the ore yard together with a new 15-ton ore bridge. Automatic hot blast temperature control of both No. 1 and No. 2 furnaces, and a complete sintering plant, including all equipment for handling ore, filter cake, dust and scale.

Open-Hearth Department: The building of three (3) new 250-ton furnaces and the rebuilding and enlarging of No. 3 furnace to 250 tons.

Blooming Mills: An extension to the soaking pits consisting of two new pits of four holes each.

Tube Mills: The addition of cross rolls and size rolls at two butt weld mills.

Coke Plant: A coal and coke handling conveyor between the coke plant and the steel plant, and the installation of two gas scrubbers.

General: Additional rolling stock consisting of ingot cars, charging cars and side-dump cars. An addition to the general works office. The remodeling of one electrical system, and the addition of a complete heat-treating shop.

Brier Hill Works

Blast Furnace: Hot blast control at Grace furnace.

Open-Hearth: Tar storage system and tar burning equipment. The installation of an ingot jarring machine.

Sheet Mills: The remodelling of the mills to handle wide sheets, roller levelers and oiling machines, and installation of a new 10-ton crane in the warehouse.

General: The installation of coke breeze stokers for four boilers; also a new 600-gal. turbine-driven boiler feed pump. Additional machine tools in the machine shop and the installation of two portable welding sets.

Struthers Works

Wire Mill: The complete installation of Nullmeyer wire drawing blocks with five straightening and cutting off machines.

Conduit: The installation of two electro-galvanizing units with necessary equipment for finishing increased production of galvanized conduit and couplings.

Merchant Mill: A 188-ft. extension to the billet yard.

South Shicago Works

A new 10-ton ore bridge and unloader. The installation of stove burners at No. 5 furnace.

A complete light oil plant at the coke department and a new coal storage with all handling equipment.

Evanston Works

Refinements and additional finishing equipment for the making of forged steel unions and the installation of a straightening machine for square and rectangular pipe.

New construction under way at the present time and scheduled for completion during 1930 is as follows:

Campbell Works

Extension, addition and alterations to the by-product plant, the remodeling of blast furnace "C," an extension to the electro-galvanizing department for couplings, the building of a complete new galvanizing department for the tube mills, and the installation of two barrel type reeling machines for the automatic seamless mill.

Brier Hill Works

Remodeling of the sheet mills and the installation of four continuous sheet furnaces, a second ingot jarring machine at the open-hearth; also the building of a new central pay station.

Indiana Harbor Works

The construction of 10-in., 14-in. and 18-in. merchant mills, a new 10-stand continuous billet mill; alteration of the electric drive for No. 1 blooming mill; an extension to the benzol plant.

Evanston Works

The building of a new electro-galvanizing department for rigid conduit and couplings.

Republic Iron & Steel Co.

The Republic Iron & Steel Co., Youngstown, reports the following improvements during 1929:

At the Thomas, Ala., plant, No. 1 blast furnace was relined. At the open-hearth works, Youngstown, a new boiler shop was installed. At the same works a new crane was added to the slab yard. At the Bessemer plant, Youngstown, a new edging stand and crane were added to the 19-in. continuous mill.

During 1930 the company expects to complete its electric welded tube mills at Youngstown now under construction, and will erect a mechanical tubing plant at the Warren, Ohio, works. At the Bessemer plant, Youngstown, the hot metal mixer unit will be remodeled.

Great Lakes Steel Corporation

The Great Lakes Steel Corporation, Detroit, now a unit of the National Steel Corporation, last spring began the construction of its new steel plant, which it is expected will be completed and ready for operation in April. The open-hearth department will have six 150-ton furnaces. The mill equipment will include a 40-in. reversing blooming mill; a 21-in., 10-stand continuous sheet bar and billet mill, and a continuous 4-high, 11-stand hot strip mill with a capacity for rolling material up to 30 in. wide. The open-hearth furnaces will be equipped with waste heat boilers. Additional finishing capacity, which has not yet been definitely decided upon, will also be added. The open-hearth furnaces and the four soaking pits are being built by Alex Laughlin & Co. There will be two reheating furnaces which will be supplied by the Chapman Stein Co. The open-hearth furnaces and the reheating furnaces will be built for the use of any fuel, but will be operated at the start on fuel oil. The soaking pits will be producer gas fired.

The mill equipment is being built by the Mesta Machine Co. and the motors by the General Electric Co. and the Westinghouse Electric & Mfg. Co. Cranes will be supplied by the Morgan Engineering Co., and these will include two 250-ton ladle cranes for the open-hearth department. The control equipment will be furnished by the Cutler Hammer Co. The Westinghouse Electric & Mfg. Co. will furnish the locomotives. The filling in and concrete foundation work is being done by the Raymond Concrete Pile Co. and Construction Materials Co.

Buildings, which include an open-hearth department, stock house, stripper building, gas producer house and soaking pits, blooming mill building and finishing mill building, are being erected by the McClintic-Marshall Co. The plant will have a capacity of 35,000 to 40,000 tons of finished steel per month.

Weirton Steel Co.

The Weirton Steel Co., Weirton, W. Va., made no major additions to its steel works or rolling mill capacity in 1929, except the installation of a warehouse and finishing department at its 48-in. mill. A turboblower of 80,000 cu. ft. per min. capacity was also completed in the blast furnace department.

During 1930 the company will reconstruct its present No. 1 blast furnace, enlarging its capacity from 700 to 1100 tons per day, embracing some changes in the stack as well as in the cast house. There will also be added to the coke plant 25 Koppers-Becker by-product coke ovens, together with necessary enlargements and improvements of by-product and benzol departments.

Plans are under way for the building of a new 24-in. structural mill, capable of making rounds and squares, angles and smaller sections of beams and channels. The mill will also be laid out so that it will be capable of rolling tie plates, splice bars and rails, and is expected to be completed and in operation by the latter part of 1930.

Inland Steel Co.

Inland Steel Co., Chicago, last year completed a new 100-ton open-hearth furnace. It is also building a new 10-in. bar mill and additional coke ovens.

Apollo Steel Co.

The Apollo Steel Co., Apollo, Pa., is erecting additional hot and cold mills, which will increase its production capacity by approximately 5000 tons monthly. The mills will be capable of finishing high-finished automobile body and furniture stock. The new equipment also includes normalizing furnaces to take care of deep drawing and extra deep drawing quality in sheet steel.

American Rolling Mill Co.

The principal new construction completed by the American Rolling Mill Co., Middletown, Ohio, last year, was mainly the building of its new continuous mill. For this year, besides minor improvements through its various plants, the company plans the installation of a new blooming mill at Middletown in connection with the continuous mill.

Interstate Iron & Steel Co.

A new 100-ton open-hearth furnace was completed last year by the Interstate Iron & Steel Co., replacing two 50-ton furnaces. The company will put in operation early this year a new 10-in. bar mill which has in combination with it a rod mill. Necessary auxiliaries, such as soaking pits, have been provided for.

Alan Wood Steel Co.

At the blast furnace department of the Alan Wood Steel Co., Conshohocken, Pa., there will be in operation early this year a new sintering plant with a capacity of 1600 tons per day.

A subsidiary, the Rainey-Wood Coke Co., put in operation last year an additional battery of 41 Koppers-Becker type cross regenerative combination ovens in one battery with three 10-ft. diameter producers, bringing the total ovens to 151 at this plant. A domestic

coke screening plant, capacity 75 tons per year, was also built.

Through a newly organized subsidiary, Alan Wood Mining Co., there has been taken over the Replogle and Oxford iron ore companies of the Warner Foundry & Pipe Corporation in Northern New Jersey. These mines will be developed and operated.

Gulf States Steel Co.

A 40-in. United Engineering & Foundry Co. electric-driven blooming mill is being added to the equipment of the Gulf States Steel Co., Birmingham, Ala. There is also being constructed a 32-in. motor-driven universal plate mill, furnished by the Mackintosh-Hemphill Co., with a capacity of approximately 14,000 tons per month of rolled sheared plate up to 72 in. wide, and of universal plate up to 45 in. Sheet mills with an initial capacity of approximately 7000 tons per month are also in process of construction but final details are undetermined.

Corrigan-McKinney Steel Co.

The Corrigan-McKinney Steel Co., Cleveland, will erect a 32-in. blooming mill this year to supplement its present 40-in. mill. This will be a standard reversing type mill which is being built by the Mesta Machine Co. An additional soaking pit furnace will also be provided. Contract for the drive for the mill has been placed with the General Electric Co. This will include a 4000-hp. reversing motor and a fly wheel motor generator set consisting of two 1600-kw. generators.

Timken Steel & Tube Co.

The Timken Steel & Tube Co., Canton, Ohio, completed last year a new seamless tube mill unit on a new site at Gambrinus, two miles west of the company's old plant. This is equipped with one 36-in. piercer, one 28-in. automatic mill, two 32-in. reelers and one 12-stand reducing mill. A complete tube finishing department was also built which includes pickling, cold drawing, annealing, tube turning, and tube storage departments and a shipping building. A scrap storage building 100 x 800 ft. was also erected. The company at present has no plans in view for extensions in 1930.

Laclede Steel Co.

Last year the Laclede Steel Co., Alton, Ill., added a new 100-ton open-hearth furnace, and in its rolling mill department built a new hot bed at its 18-in. mill, a billet heating furnace and a 10-in. 4-high mill. It also enlarged the furnace on its 8-in. strip mill and added a new hot bed and a new roughing mill.

The Laclede Tube Co. has constructed a new butt weld unit.

Otis Steel Co.

The Otis Steel Co., Cleveland, last year installed three cold mills in its sheet mill department. These are 54-in., 60-in., and 82-in. mills. A 3-ton Pittsburgh electric furnace was installed in its Lakeside foundry department. The company has under consideration a program for construction in 1930, but no definite plans have been completed.

Central Alloy Steel Corporation

The Central Alloy Steel Corporation, Massillon, Ohio, is now installing a 25-ton Heroult electric furnace, which it expects to have in operation early in 1930. This is being built by the American Bridge Co. and the transformers and switching equipment are being furnished by the General Electric Co. Construction activities last year were confined largely to miscellaneous improvements of existing equipment. No additional steel producing or rolling equipment is at present being considered for 1930.

Ford Motor Co.

The Ford Motor Co., Fordson, Mich., during the present year will enlarge the kilowatt output of its power house. One 110,000-kw. unit and two 1400-hp. boilers will be installed and a 15-ft. diameter tunnel will be built to secure a water supply from the Detroit River. The installation of additional rolling mill equipment this year is not contemplated. Three 100-ton open-hearth furnaces were completed early last year.

Empire Steel Corporation

Empire Steel Corporation, Mansfield, Ohio, started last year the construction of two additional 110-ton open-hearth furnaces, which are expected to be completed this month. Cranes and other auxiliary equipment were installed. This company also constructed during the past year at its Mansfield plant six normalizing furnaces and five continuous sheet furnaces. It expects to add additional continuous pack heating furnaces this year.

Continental Steel Corporation

The Continental Steel Corporation, Kokomo Works, Kokomo, Ind., last year completed one 100-ton open-hearth furnace, which brings the total at this plant to five furnaces. A new sheet plant consisting of six sheet mills and four galvanizing pots was also built.

Wisconsin Steel Co.

A 600-ton blast furnace and 45 additional by-product coke ovens, with the necessary units to support these two major additions, are being constructed by the Wisconsin Steel Co., Chicago. It is expected that this work will be consummated during the second quarter of this year.

Heppenstall Forge & Knife Co.

Heppenstall Forge & Knife Co., Pittsburgh, last year increased the capacity of each of its two 18-ton acid open-hearth furnaces to 25 tons. It also installed a new annealing division in its shear knife department. Plant additions include a billet and ingot storage department and a carpenter shop.

John A. Roebling's Sons Co.

The John A. Roebling's Sons Co., at its Kinkora Plant, Roebling, N. J., completed and put in operation during 1929 a continuous rod mill for rolling principally high-carbon steel, and an 18-in. billet mill to roll 2-in. billets, and a 9000 kva. substation equipment. There were also completed two 4-hole producer, gas-fired soaking pits in the blooming mill.

There is under construction a copper wire drawing mill, 200 ft. by 500 ft., to replace the copper wire-drawing equipment to be abandoned at the Trenton Plant, and to provide for additional capacity.

Complete electrification of wire mills Nos. 1 and 2 has been commenced.

An electrically driven water works, for general mill supply, and of an initial capacity of 20,000,000 gal. per day, to replace the present steam pumping equipment, is in the 1930 program.

At the Trenton Plant, Trenton, N. J., there is in progress the entire rebuilding and enlargement of rope shop No. 1. The north and south sections have been completed to be followed in 1930 with the rebuilding of the central section.

An extension to rope shop No. 3 is under construction and will be completed early in 1930.

Follansbee Brothers Co.

The Follansbee Brothers Co., Pittsburgh, installed a 30-in. x 66-in. sheet mill at its Toronto, Ohio, plant during 1929, which increased its full finishing sheet capacity by 12,000 tons per year. Late in the year the company completed the electrification of both its hot and cold mills at the Follansbee, W. Va., plant.

Midvale Steel Co.

Acquisition of Chrome Alloy Products, Inc., Philadelphia, with an annual capacity of 1000 tons of heat and corrosion-resistant castings, was made by the Midvale Steel Co., Nicetown, Philadelphia, late last year. New machine tools for manufacturing in machine shops were installed at Nicetown.

Central Iron & Steel Co.

The Central Iron & Steel Co., Harrisburg, Pa., last year installed nine 250-hp. waste heat boilers on the heating furnaces of its plate mills. All of its plate mill furnaces are now fired with pulverized coal and equipped with waste heat boilers. A new 1250-kw. motor generator set was installed in a new sub-station building. The coal pulverizing plant was increased by an addition of a 54-in. Fuller-Lehigh coal pulverizing mill. For the flanging department a 300-ton hydraulic press will be installed within the next few months.

Sheffield Steel Corporation

A 100-ton oil-fired basic open-hearth furnace was completed last year by the Sheffield Steel Corporation, Kansas City, Mo. There was also built a new scrap and material handling yard, 150 ft. by 500 ft., serving the open-hearth department. In the rolling mill department the following new equipment was installed: One 24-in. one-stand finishing mill; one 18-in. 4-stand continuous billet mill; one 7-stand continuous rod and merchant mill, 14 in., 12 in. and 10 in., and one wire, nail and fence plant also for the production of a full range of wire products.

Wheeling Steel Corporation

At its Steubenville, Ohio, works, the Wheeling Steel Corporation, Wheeling, W. Va., completed an 11-stand, 60-in. continuous hot strip mill, electrically driven throughout, with a capacity of 30,000 tons per month. The company also rebuilt its 45-in. blooming mill at Steubenville, equipping it with motor drive.

During 1930 the company expects to complete the enlargement of No. 1 Labelle blast furnace, Steubenville, increasing its capacity from 450 to 800 tons daily. The company also will install a 48-in. electrically driven, cold-rolled mill with finishing, pickling and annealing equipment at the Steubenville plant.

Other Steel Works Additions

The Granite City Steel Co., Granite City, Ill., completed last year a slab furnace for its plate mill, a new maintenance department building, housing all maintenance trades, such as blacksmiths, machinists, carpenters, pipe fitters, etc.,

and extensions to its warehouses. This year it plans to add 10,000 tons of additional black sheet capacity with complementary equipment.

The American Tube & Stamping Plant at its Stanley works, Bridgeport, Conn., is completing a new 20-in., 14-in., 12-in. cross country strip mill with 11 stands. It will be ready for operation about March 1. No increase in capacity is obtained, but the mill will replace two mills which are now operating.

Two stands have been added to the rod mill of the Keystone Steel & Wire Co., Peoria, Ill., and the capacity of the open hearth department has been increased by replacing crane and ladle equipment to facilitate the tapping of larger heats up to 120 tons. New wire-drawing machinery has been developed by the company.

The Colorado Fuel & Iron Co., Pueblo, Colo., will add this year 42 new coke ovens to its present two batteries of 60 ovens each.

New boilers and powdered coal furnaces were installed last year by the Page Steel & Wire Co., Monessen, Pa.

The Sharon Steel Hoop Co., Sharon, Pa., during 1929 completed and placed in operation a new Morgan 14-in. continuous hot strip mill, with its own power plant, gas plant and auxiliary equipment.

The Universal Steel Co., Bridgeville, Pa., installed a 10-in. 3-high merchant bar mill.

New Electric Furnace Steel Capacity

BESIDES the 25-ton Heroult furnace being put in by the Central Alloy Steel Corporation and the 3-ton Pittsburgh furnace by the Otis Steel Co., the following installations are reported:

The Allegheny Steel Co., Brackenridge, Pa., during the year installed four additional electric melting furnaces, bringing its total to nine. Considerable rearrangement and alteration of equipment was also necessary in its alloy steel departments. Appropriations have already been made for 1930, covering additional electric melting furnaces, electric heating and annealing equipment and Steckel 4-high cold mills.

During 1930 the Carpenter Steel Co., Reading, Pa., will install a 1000-lb. high-frequency induction melting furnace made by the Ajax Electrothermic Corporation, Trenton, N. J. There will also be a complete change of its mills from steam-driven to motor-driven equipment.

One electric annealing furnace has been added to the equipment of the Vanadium-Alloys Steel Co., Latrobe, Pa. At its Colonia Steel Co. plant a 3-ton Heroult electric furnace has been changed to one of 6-ton capacity.

In 1929 the Ludlum Steel Co., Watervliet, N. Y., installed a new heat-treating department, a heating furnace for its 9-in. merchant mill, an experimental ¾-ton electric furnace and a Ruths steam storage tank. A Strauss metal plant was also built. No definite 1930 program has been decided upon.

The Collins Co., Collinsville, Conn., has installed a new 500-lb. Pittsburgh electric furnace to replace two 30-pot crucible furnaces which have been in operation for the past 60 odd years.

In addition to these electric furnaces, there are new installations reported by foundries on another page.

Blast Furnace Construction

IMPROVEMENTS and additions to blast furnace construction, not included in the foregoing reports of steel companies, are presented as follows:

Davison Coke & Iron Co., Pittsburgh, during the year replaced three steam blowing engines with two turboblowers at its Neville Island furnace, and also installed a new boiler plant and cement works. Two units of Koppers-Becker by-product coke ovens, consisting of 35 ovens each, were also placed in operation, with complete coal handling equipment, by-product, benzol and gas purification units. The ovens have a capacity of 630,000 tons of coal annually, and 441,000 tons of coke.

The Hanna Furnace Co. plans during 1930 to rebuild its "A" furnace at Detroit and to increase its capacity to 1000 tons per day. One or more of the present stoves will probably be dismantled and replaced. A new power plant will also be built. This rebuilt stack will be used to supply pig iron for the merchant trade, and the present B stack will furnish hot metal for the steel plant of the Great Lakes Steel Corporation.

A new blast furnace was blown in last year by the Globe Iron Co., Jackson, Ohio. Its size is 87½ ft. by 18 ft. by 14 ft. 6 in., with McKee top and distributor. Five stoves, a pig iron casting machine and Baker type bins were added, as well as the increasing of the power and boiler equipment. The furnace jacket is built to accommodate larger lines.

A new 150-ton Dwight-Lloyd sintering machine was placed in operation Dec. 1, 1929, by the Hamilton Coke & Iron Co., Hamilton, Ohio.

The Federal Furnace Co., South Chicago, Ill., has not yet completed its 1000-ton blast furnace, scheduled a year ago for building. It may be completed this year.

Additions to Rolling Mills

SUBSTANTIAL additions to the rolling mill departments were made by large steel-making companies last year, enumerated in preceding pages. Other information from other companies follows:

Last year a new 10-in. continuous hot strip mill with a range from ¾ in. to 6 in. was put in operation by the Acme Steel Co., Chicago. It has a capacity of about 10,000 tons per month. This mill has a 250-ft. cooling bed with apparatus for cutting hoops and bands, in its range, to length. There has also been put in operation one continuous 4-high cold mill train of four stands. This mill will roll material up to 20 in. wide.

The Simmons Co., San Francisco, Cal., last year completed a 16-in. independent set of rail-slitting rolls driven by a 500-hp. synchronous motor at 450 r.p.m. This motor is connected to a Falk gear-reduction unit, driving the 16-in. mill at 60 r.p.m.

Last year the Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, constructed a new heating furnace for its 10-in. bar mill. Another new furnace of the same type will be built the early part of this year. Both are oil-fired.

The Newton Steel Co. has about completed its new plant at Monroe, Mich., which will consist of eight sheet mills designed to produce high finished automobile stock. It will have a capacity of 20,000 tons of sheets monthly, which is about the same as that at its plant at Newton Falls, Ohio. Commercial production is expected this month.

A new sheet mill will be started early this year by the Tarentum Steel Corporation near Pittsburgh. It is to be erected on the site of the old No. 2 plant of the Pittsburgh Plate Glass Co. It will contain six complete sheet mills and will have an annual capacity of 55,000 to 65,000 tons of full finished sheets.

The Eastern Rolling Mill Co., Baltimore, Md., is now installing continuous sheet pack heating furnaces which will be in operation early this year, displacing the method at present in use.

The Kilby Car & Foundry Co., Anniston, Ala., last year increased the capacity of its 10-in. and 8-in. mills by installing larger motors. More hot bed capacity and more roll-stand capacity will probably be added this year.

The Highland Iron & Steel Co., Chicago, last year put into operation a new 8-in. mill to roll small bars and shapes of wrought iron.

Equipment was added last year by the Tremont Nail Co., Wareham, Mass., to manufacture special high-carbon hardened steel floor nails.

The West Leechburg Steel Co., Pittsburgh, is building a 14-stand, 12-in. continuous hot strip mill with auxiliary equipment, at its Leechburg, Pa., works, which will be ready for operation by April 1, 1930.

The Union Drawn Steel Co., Beaver Falls, Pa., during 1930 expects to slightly expand its mill at Gary, Ind.

Steel and Tubes, Inc., Cleveland, completed last year a new plant at Ferndale, Detroit, containing 120,000 sq. ft. for making light-gage electrically welded steel tubing. There is now under construction at Warren, Ohio, a 68,000-sq. ft. conduit plant to be completed early this year.

Additions to Steel Foundries

Additions to capacity and equipment by steel foundries are reported as follows:

Three 50-ton basic open-hearth furnaces are being built at the Eddystone division of the General Steel Castings Corporation in its new plant, Eddystone, Pa. The company expects to turn out 5000 tons of castings per month from two of these furnaces. Complete equipment for taking care of the product is also being installed.

An electric furnace, rated at 1½ tons per hr., was added last year to the equipment of the Malleable Iron Fittings Co., Branford, Conn., for the manufacture of steel castings.



Ernest T. Weir



T. M. Girdler



Leopold E. Block



John A. Topping
Vice-president



E. A. S. Clarke
Secretary



Jesse F. Welborn



Alva C. Dinkey



Ross H. McMaster

Holidays Slow Up European Business

Little Activity Until Break of Year—Cartel Prices and Extras Cause Uncertainty—Labor Trouble at Antipodes

(*By cablegram*)

LONDON, ENGLAND, Dec. 30.

ALL iron and steel markets are under the influence of the holidays. Plants on the Northeast Coast have now been re-opened, but those in Scotland are closed for all of this week. The furnaces, generally, are fairly well placed.

Finished steel remains quiet, with official prices unchanged.

Tin plate markets are reviving after the Christmas holiday. Most mills have resumed operations, with healthy order books and good prospects.

Galvanized sheets are quiet and black sheets are idle.

Ships launched on the Clyde in 1929 numbered 234 vessels, aggregating 566,000 tons gross register.

On the Continent of Europe

Continental markets are idle, on account of the holidays and uncertainties regarding recent European Raw Steel Cartel negotiations for fixing prices and extras. It is stated that the association is adopting merchant bar extras as formulated by the German Steel Association.

The German Raw Steel Cartel and affiliated syndicates have been renewed for a period of ten years, dating from Feb. 1 next, with a proviso permitting members to denounce adherence to it after five years, if they so desire.

Belgian November output included 340,000 metric tons of pig iron, 324,000 tons of raw steel and 286,000 tons of rolled steel. There were 58 blast furnaces active at the end of November.

German production in November was 1,286,000 metric tons of raw steel and 868,000 tons of rolled steel.

Less Steel and Iron Made in Canada

Canadian pig iron production in November was 86,516 gross tons, or 5 per cent less than in October and 9 per cent below that in November, 1928, according to information received by the United States Department of Commerce from Commercial Attaché Lynn W. Meekins, Ottawa. The production of steel declined also, to a total of 93,648 tons in November, 19 per cent under the October output and 14 per cent less than that of November, 1928.

Australian Steel Output Cut by Labor Troubles

The continuance of the labor troubles in the coal fields of New South Wales is still reflected in the production figures of the principal unit of the Australian iron and steel industry, the Newcastle Works of Broken Hill Property, Ltd., says a report received by the Department of Commerce, Washington, from Sydney. Statistics for the four-week period ended Oct. 6 show an output of 13,273 tons of pig iron and 21,001 tons of raw steel, comparing with 12,011 tons and 20,203 tons respectively for the period ended Sept. 8, and with 32,215 tons of pig iron and 28,277 tons of steel for the period ended Oct. 7, 1928. Figures for the output of the first 16 weeks of the company's financial year, to Sept 8, showed a loss in the production of pig iron amounting to 55,635 tons, or 53 per cent, compared with the same period of last year, while steel output dropped 34,065 tons, or 30 per cent.

St. Louis Industrial Growth in 1929 Large

George C. Smith, director of the St. Louis Industrial Bureau, in his annual report to the Industrial Club, states that 76 new industries and 124 expansions in St. Louis were announced in 1929, which, when completed, will represent an aggregate investment of $79,450,000, will require 1,967,334 sq. ft. of floor space and afford employment for 6122 additional workers. Mr. Smith predicted that the early months of 1930 would witness a number of acquisitions of plants of major importance.

British and Continental European Export Prices per gross ton, f.o.b. United Kingdom Ports, Hamburg and Antwerp, with the £ at $4.88

British Prices f.o.b. United Kingdom Ports

Cleveland No. 3 foundry	£3	12½s.	to	£3	13½s.	$17.69	to	$17.93
East Coast hematite	3	19	to	4	0	19.28	to	19.52
Ferromanganese, export	12	5	to	13	0	59.42	to	63.05
Billets, open-hearth	6	2½	to	6	5	29.89	to	30.50
Sheet bars, open-hearth	5	17½	to	6	10	28.67	to	31.72
Black sheets, Japanese specifications	12	10				61.00		
Tin plate, per base box	0	18¾	to	0	19	4.57	to	4.64
Rails, 60 lb. and heavier	7	15	to	8	15	37.59	to	42.43
						Cents per Lb.		
Steel bars, open-hearth	8	0	to	8	10	1.74	to	1.85
Beams, open-hearth	7	7½	to	7	12½	1.60	to	1.66
Channels, open-hearth	7	12½	to	7	17½	1.66	to	1.72
Angles, open-hearth	7	7½	to	7	12½	1.60	to	1.66
Ship plates, open-hearth	7	15	to	8	2½	1.69	to	1.77
Black sheets, No. 24 gage	10	0	to	10	5	2.18	to	2.23
Galvanized sheets, No. 24 gage	12	7½	to	12	10	2.69	to	2.72

Continental Prices, f.o.b. Antwerp or Hamburg

Foundry iron, 2.50 to 3.00 per cent sil., 0.50 to 0.90 per cent phos.	£3	7s.	to	£3	11½s.	$16.35	to	$17.45
Foundry iron, 2.50 to 3.00 per cent sil., 1.00 per cent and more phos.	3	6	to	3	8	16.11	to	16.59
Billets, Thomas	4	11	to	4	12	22.20	to	22.45
Sheet bars, Thomas	4	11	to	4	13	22.20	to	22.69
Wire rods, low C., No. 5 B.W.G.	6	3	to	6	5	30.01	to	30.50
Rails, 60 lb. and heavier	6	8½	to	6	10*	31.35	to	31.72
Rails, light	6	1½				29.65		
						Cents per Lb.		
Steel bars, merchant	5	5	to	5	6	1.14	to	1.15
Steel bars, deformed	5	3	to	5	5	1.12	to	1.14
Beams, Thomas, British standard	4	19	to	5	2	1.08	to	1.11
Channels, Thomas, American sections	5	10	to	5	17	1.19	to	1.27
Angles, Thomas, 4-in. and larger, over ⅝-in. thick	5	0	to	5	6	1.09	to	1.15
Angles, Thomas, 3-in.	5	6				1.15		
Ship plates open-hearth inspected	7	5				1.58		
Black sheets, No. 31 gage, Japanese	12	3	to	12	4	2.47	to	2.66
Hoop and strip steel over 6-in. base	5	11½	to	5	12½	1.21	to	1.22
Wire, plain, No. 8 gage	7	0				1.52		
Wire, galvanized, No. 8 gage	8	10				1.84		
Wire, barbed, 4-pt. No. 12 B.W.G.	11	4	to	11	6	2.44	to	2.46
Wire nails, base	0	6¼				$1.55	per	keg
Wire nails, assortments 1 to 6-in. keg	10	6½				2.69		

*Open-hearth steel, 8s. ($1.94) per ton extra.

A. I. FINDLEY
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THE IRON AGE

W. W. MACON
Managing Editor

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What of 1930?

IF a high percentage of the construction, improvement and re-equipment programs discussed in the past few weeks is carried to full completion, as seems likely, the year 1930 ought to provide a reasonable return on industrial investments and therefore be classed as a good year; but it will require attendant activity of industries not articulate at Washington to make it more than good. If we have been going too fast, a slackened speed would be better than a return to the old pace, only to fall later into a halting gait, thus to catch our breath.

It is difficult to find reasons why the steel and iron consuming industries should not do well this year. The favorable factors have had much examining in these columns and elsewhere, notably at the Washington business conferences, and need not be restated. It remains for a statistical study to suggest that all is not so well, that there has been overproduction, for instance. The statistics of course do not diagnose the nature of the overproduction, and so the obvious deduction, in view of the admitted low inventories in all the stages of manufacture, is that there has been overbuying by the final consumer. If such is the case, he must remain sated for some time, unless he can be relieved of the fact, or the illusion, if such it be.

Here's about the argument of the statistics on steel: The recent past shows a consumption in the United States of about 850 pounds of crude steel per person a year, augmented annually by about 8 pounds. Last year output was 16.3 per cent more than these so-called normal needs, and for the last two years combined it was 13 per cent in excess. Instead of turning out in the two years 92,000,000 tons of open-hearth and Bessemer ingots, as being all that would suffice were consumption perfectly synchronous with production, the industry made over 104,000,000 tons. So, say the figures, the industry can hardly keep up the 1929 rate unless America is beginning to use steel at a greatly accelerated rate.

Normal needs for 1930, according to the chart of production published once a month in THE IRON AGE, are of the order of 47,500,000 tons, representing a recession of 12 per cent from the 1929 output and a rate of operations, on the total capacity which will be available this year, of 73 per cent. Such an output would not reduce the apparent, calculated excess of 12,000,000 tons of the last two years, but with the general temper or psychological attitude of business today any lower output would be combatted as inadmissible. The one metal consuming industry regarded as subject to deepest cutting, the automobile, will fall off, according to an unpublished estimate, a matter of 17 per cent. That leaves for all the rest of the industries a relatively smaller average drop.

What is important is that a 73 per cent rate should represent, as it has in the past, a scale of activity that is more than sufficient, with stability of prices and continued economies, to meet easily regular dividend requirements. Even so large a decline as the figures suggest is not particularly drab, seeing how high a level was maintained last year.

Demands of Metal Consuming Industries

AN estimate of this year's needs in steel may be made by considering the annual consumption of the major industries in recent years, as covered on pages 10 and 11 of this issue, and taking into account the best available information about the sentiment today in those industries. Such an estimate follows:

Between 1923 and 1926 the railroads bought steel at an equivalent of 11,000,000 tons of ingots; since then the level appears to be more like 8,750,000. Contracts already let for rails and cars seem to guarantee that 1930 will represent a high point in railroad buying in recent years. Assume 10,000,000 tons.

Real difficulty appears when one attempts to estimate the steel takings of the automotive industry. If tonnage of steel to the industry, total tonnage of ingots and total number of cars are plotted since 1923 the three curves show striking parallelism; in fact, the latter two are so similar in shape that one might assume that 10 tons of ingots are sold for each automobile. If that were true, one would need merely guess the number of cars to be made in 1930, multiply it by ten and the result would be the total steel output. On another page this number of automobiles is estimated at 4,500,000; does 45,000,000 tons represent the 1930 steel?

Even though it must be admitted that activity of the automotive industry is reflected far back into other machinery and metal working lines, it should be pointed out that gross steel production does not fluctuate so violently as the motor trade. For instance, in 1927 the number of cars made dropped to about 3,600,000, whereas the steel total was 44,000,000 tons. It would be better to accept the estimated production of cars as a "Yankee guess"; if the figure of 4,500,000 is approximately correct, then the classification "automobiles" will absorb at least 7,250,000 tons in 1930.

The share of machinery has declined since 1926, but the amount for 1930 may be put at 1,600,000 tons of ingots.

The quantity of food and other commodities put into sheet metal containers appears to absorb a steadily

increasing tonnage of steel, and there is no reason to suspect that this trend will be halted. Assume 1,800,000 tons.

Steel taken by agriculture appears to have reached a crest in 1928. While all reports agree the farmer's income in 1929 has been unusually satisfactory, let us assume that his consumption is on a declining cycle and put it at 2,750,000 tons in 1930, against 3,000,000 in 1929.

Exports since 1923 have fluctuated about 2,750,000 tons as a mean. Continued pressure from Great Britain, France and Germany will prevent any great departure from that figure next year.

Steel absorbed by oil, gas, water and mining has shown a sharp increase since 1927. In the present overexpanded condition of the petroleum industry and the large stocks in storage, it can safely be assumed that 1929 represented a peak in the curve. Assume a drop back to 1928 or 4,750,000 tons.

Volume of building construction (at least as measured by steel consumed) also appears to have reached a peak in 1927. Even though the various building programs for State and nation, recommended by President Hoover, get under way quickly, it would be proper to estimate 1930 at somewhat less than 1929; say 8,000,000 tons.

It is impossible to classify between 7,000,000 and 10,000,000 tons of steel each year; suppose this figure is the average since 1923 or 8,400,000 tons.

Summarizing, the total ingot production for 1930 will be (barring some psychological panic):

	Tons
Machinery	1,600,000
Containers	1,800,000
Agriculture	2,750,000
Exports	2,750,000
Oil, etc.	4,750,000
Building	8,000,000
Railroads	10,000,000
Automobiles	7,250,000
Unclassified	8,400,000
Estimated total	47,300,000

The foregoing estimate was obtained independently of the one in the preceding editorial, which assumes that the country will do well if it may produce what has been found to be the normal needs of the year. In the two cases output is fixed at over 47,000,000 tons. Only two years in our history—1928 and 1929—have reached this figure. No one foresaw that 1929 would surpass 1928, a super-normal year, so these estimates may perhaps be taken until a few months pass by and give us a measure of how we are proceeding.

Steel Production Will be Steady

WHATEVER may be the total steel production of 1930, the rate of production will be relatively steady. The year starts out with work in progress requiring steel. There is no room for a fresh scare and no likelihood of men becoming unduly sanguine. Buying will be conservative, with no disposition to anticipate, and we know perfectly well that in the past, as a rule, the rate of steel production has fluctuated more than the rate of actual ultimate consumption, owing largely to men changing their minds. Men are going to go through 1930 with a steady mind.

We may need to refresh our memories as to how widely steel production has fluctuated during given years. The fluctuations are readily presented by taking average production during a year and computing the percentage deviation of the low and the high month respectively. Adding these two percentages gives the fluctuation—98 points for 1921 and only 17 points for 1928. June, the low month in 1928, was 10 per cent under average while April, the high month, was 7 per cent above the average. The last ten years have stood in the following sequence as to steadiness:

Steadiest	Total Variation
1928	17
1926	22
1925	29
1927	29
1920	30
1922	31
1923	31
1929	45
1924	76
1921	98
Unsteadiest	

Steadiness and unsteadiness are not related to total size except in a rough way, light years tending to be the less steady. The years 1925 and 1927 had the same degree of steadiness but the later year was decidedly the smaller. The year 1921, with its wide variation, need not be considered seriously, as it started with a little of the 1920 momentum. In both 1924 and 1929 something went seriously wrong, bringing about a wide variation. There is no room left for that in 1930.

The up and down divergences of the last ten years are shown in the following table, computed for each year from the average rate through the year, the rate in the high month and the rate in the low month.

Deviation of High and Low Monthly Ingot Outputs

	Largest Per Cent Above	Largest Per Cent Below	Sum of Divergences
1920	11	19	30
1921	57	41	98
1922	18	13	31
1923	13	18	31
1924	37	39	76
1925	13	16	29
1926	10	12	22
1927	20	9	29
1928	7	10	17
1929	11	34	45
Sum	197	211	408

The low month of 1929 was of course December and the figure given is estimated, as the official report of the month's production has not yet been issued.

Must Machinery Makers Hold Aloof?

AS a by-product of the National Business Survey Conference held in Washington, December 5, it is interesting to examine the presentations made by various branches of industry. Those well organized were in a position to meet the situation effectively, while the others, some of them more important, could make only an incomplete contribution. This is in no sense a criticism of the spokesmen in these instances. They met the obligation of the hurried call and, without the facilities of a central information bureau, made responses that were surprisingly satisfactory to the industries concerned.

The machinery industry is prominent among those without adequate organization. There are about 10,000 firms in the United States manufacturing ma-

chinery. In this group there are about forty trade associations of one kind or other. The total membership of this group is less than a thousand. In other words, the machinery industry is less than 10 per cent organized and this 10 per cent is split forty ways.

As a consequence, when General Otto H. Falk, president of the Allis-Chalmers Manufacturing Company, was asked to report to the conference in Washington regarding economic conditions in one of the most important of American industries, he was given a difficult assignment. That he was able to marshal data that fitted into the purpose of that unusual gathering is greatly to his credit. He had no national organization to fall back upon for help, a situation in striking contrast to that of the gentlemen representing the railroads, the various branches of the electrical industry, the construction industry and others. That he had to depend in part on an eleventh-hour investigation serves to emphasize the relatively disadvantageous position of the machinery manufacturers in the emergency.

The illustration is offered to point out sharply that at present the machinery industry has no one to represent it when legislative problems are involved. The industry has no "public relations," so called. No one acts for it as the various institutes and trade associations act for other leading American industries. In the foreign field it suffers similar disabilities because in other countries the machinery industry is highly organized and effectively represented.

The situation has even a more serious side. Managers of machinery corporations are deprived of information they could well use in matters of daily administration. In the absence of statistical and other knowledge, they lack one of the big aids of organized effort. An unsatisfactory profit experience of the group should arouse interest in organization.

It may be that the individualistic character of machinery manufacture is responsible for the independent attitude of going it alone, company by company, or small group by small group. Certainly the basis for broader cooperation is now available through the loosely-knit occasional meetings of the managers of the several machinery trade associations. One such meeting is scheduled for Washington on February 3, and in this the leaders of the industry should join with the association executives to discuss the feasibility of some degree of federation. The time has now come to consider whether some of the individualism should not be discarded in order that the industry, as a whole, may enjoy the benefits of complete organization.

Farm Equipment Prospects Reasonably Encouraging

"REGARDED as a whole our 1929 business, including both the domestic and foreign trade, and notwithstanding unfavorable crop conditions in some parts of the United States and Canada, has been quite satisfactory," says George A. Ranney, vice-president and treasurer, International Harvester Co., Chicago, in a statement prepared for THE IRON AGE.

"Generally speaking, agriculture in this country has had a fairly prosperous year. The slow but steady improvement in conditions since the great depression of 1920-1921 has continued through 1929, and the farmer has shown increasing interest in the economies of production made possible by more efficient labor-saving machinery.

"The outlook for 1930 is reasonably encouraging, both in the domestic and export trade. Provided that crop conditions average up fairly well, we believe it should prove a year of normal business."

Pullman Will Acquire Two Car Companies

A merger involving $50,000,000, by which Pullman, Inc., will take over the Standard Steel Car Co. and the Osgood Bradley Car Co., was recommended to stockholders of the three companies by their boards of directors last week. A meeting of stockholders of Pullman, Inc., has been called for on Jan. 28, at Wilmington, Del., to authorize an increase in the company's capital stock from 3,375,000 to 3,875,000 shares.

This stock, valued at more than $43,000,000, will be issued in payment for the lands and associated properties of the Standard and Osgood Bradley Companies, and for acquisition, directly or indirectly, of the properties of the Middletown Car Co. and the Entreprises Industrielles Charentaises.

The Standard Steel Car and Osgood Bradley Car Companies own and operate plants manufacturing railroad passenger and freight cars, street cars, steel forgings, gray iron castings, etc., at the following locations: Butler, Pa.; Hammond, Ind.; Baltimore; St. Paul, Minn.; Richmond, Va.; Worcester, Mass.; Sagamore, Mass.; Elwood City, Pa.; La Rochelle, France, and Rio de Janeiro, Brazil. The Middletown Car Co. owns and operates a car assembling plant at Rio de Janeiro, while Entreprises Industrielles Charentaises owns and operates a freight and passenger car plant at La Rochelle, France.

In addition to the plants and sales offices, Pullman, Inc., is acquiring certain lands and housing properties owned by Standard Steel Car Co. or subsidiaries. The companies being purchased will be operated by a newly incorporated subsidiary of Pullman, Inc., to be wholly owned by that company, but to be operated separately from its present car manufacturing subsidiary, the Pullman Car & Mfg. Co.

J. F. Drake, now president of the Standard Steel Car Co., will become chairman of Pullman, Inc., and D. A. Crawford will continue as president.

Car Loadings of Steel May Drop 4.6 Per Cent

WASHINGTON, Dec. 30.—Car loadings of iron and steel for the first quarter of 1930 are estimated by the 13 shippers' regional advisory boards at 514,868, according to the Car Service Division, American Railway Association, reflecting a decrease of 4.6 per cent under the actual 539,582 car loads in the corresponding period of 1929.

First quarter car loadings in 1930 for machinery and boilers are estimated at 48,913.

The sharpest estimated drop is in automobiles, trucks and parts, fixed at a total of 246,746 cars for the first quarter, as against 285,313 for the first quarter of 1929, a decline of 13.5 per cent.

The estimated carload shipments of the 29 principal commodities in the first quarter of 1930 is 7,664,499, a reduction of 43,905 cars, or six-tenths of 1 per cent from the 7,708,404 cars loaded the first quarter of 1929.

Fabricated Structural Steel

Most of Awards, Totaling 41,000 Tons, are in New York District—Inquiries Amount to 32,000 Tons

THE New York district contributed the major portion of the tonnage in structural steel in the past week. Awards totaled 41,000 tons, of which 28,000 tons were in the New York area. The largest job was 18,700 tons for a Brooklyn subway section. Fresh inquiries amounting to 32,000 tons came out for bids. The outstanding inquiry was 12,600 tons for electrification work on the Pennsylvania Railroad. Awards follow:

MAINE CENTRAL RAILROAD, 400 tons, bridge, to unnamed fabricator.

NEW YORK, 18,700 tons, subway section 3, route 109, in Brooklyn, to American Bridge Co.

NEW YORK, 3500 tons, Walton High School in Bronx, to Bethlehem Fabricators, Inc.

NEW YORK, 1100 tons, apartment building at 433 West Thirty-fourth Street, to Taylor-Fichter Steel Construction Co.

NEW YORK, 1600 tons, apartment building on East Seventy-second Street, to Taylor-Fichter Steel Construction Co.

NEW YORK, 600 tons, apartment building on East Thirty-first Street, to Hinkle Iron Works.

NEW YORK, 375 tons, theater on Staten Island, to Hinkle Iron Works.

NEW YORK, 1100 tons, annex to Savoy-Plaza Hotel, to McClintic-Marshall Co.

VALLEY STREAM, N. Y., 325 tons, hangars at Roosevelt Field, to Jones & Laughlin Steel Corporation.

SAYVILLE, N. Y., 200 tons, bridge for Long Island Railroad, to American Bridge Co.

YONKERS, N. Y., 150 tons, highway bridge for Westchester County Highway Commission, to Penn Bridge Co.

NEWARK, N. J., 225 tons, subway sections Nos. 4 and 5, to American Bridge Co.

PHILADELPHIA, 900 tons, alterations to Presbyterian Hospital, to Bethlehem Fabricators, Inc.

SOUTH BEND, IND., 200 tons, foundry, to Rochester Bridge Co., Rochester, Ind.

CHICAGO, 1000 tons, Twelfth Street viaduct, to American Bridge Co.; previously reported to an unnamed bidder.

CHICAGO, 3500 tons, Wabash Avenue bridge, to an unnamed bidder.

MILWAUKEE, 450 tons, steel piling, to an unnamed bidder.

SAN ANTONIO, TEX., 3675 tons, administration and equipment building for Southwestern Bell Telephone Co., to McClintic-Marshall Co.

SACRAMENTO, CAL., 1338 tons, San Luis Rey River bridge, to United States Steel Products Co.

SEATTLE, 1000 tons, Fourteenth Avenue South bridge, to an unnamed company.

SEATTLE, 370 tons, Dumas Bay bridge, to an unnamed company.

Structural Projects Pending

Inquiries for fabricated steel work include the following:

STATE OF NEW YORK, 330 tons, bridge in Niagara County.

NEW YORK, 1900 tons, building for Central Hanover Bank & Trust Co. at Sixth Avenue and Thirty-fifth Street.

NEW YORK, 2000 tons, airport in Brooklyn for Department of Docks.

NEW YORK, 1600 tons, apartment building on Forty-ninth Street.

NEW YORK CENTRAL RAILROAD, 525 tons, grade crossing elimination at Memphis, N. Y.

PENNSYLVANIA RAILROAD, 12,600 tons, electrification in West Philadelphia yards and on main line from Trenton to New York; bids opened Jan. 6.

PHILADELPHIA, 240 tons, viaduct at Thirtieth and Arch Streets; Seeds & Durham, low bidder on general contract.

PHILADELPHIA, 1100 tons, bridge at Henry Street; F. A. Canuso & Son, low bidder.

PHILADELPHIA, 2500 tons, Eighth Street subway; Henry W. Horst & Co., low bidder on general contract.

ROGERS CITY, MICH., 600 tons, power house for Michigan Limestone & Chemical Co.

DETROIT, 2500 tons, Union League Club building.

DAYTON, OHIO, 3000 tons, telephone exchange.

MILWAUKEE, 550 tons, coal handling bridge.

CAMDEN, ARK., 600 tons, bridge for Frisco Lines.

NEWPORT BEACH, CAL., 150 tons, bridge on Lido Island; bids Jan. 6.

SAN DIEGO, CAL., 5200 tons, pipe line; Western Pipe & Steel Co., low bidder.

LOS ANGELES, 398 tons, 24 and 36-in. hammerwelded or lapwelded steel pipe; bids Jan. 3.

Railroad Equipment

Van Sweringen Roads Inquiring for 11,505 Cars

THE Chesapeake & Ohio, Pere Marquette and Hocking Valley have put out an inquiry for a total of 11,505 freight cars and 130 locomotives and soon will ask for bids on 146 passenger cars. Including this list from the Van Sweringen interests, orders are now pending for 16,450 cars, all of which probably will be placed before the end of January. Inquiries are expected soon from the St. Paul for 1000 cars, Lehigh & New England for 1000 cars and Louisville & Nashville for 1800 cars. The 1930 program of the New York Central is said to call for a minimum of 7000 freight cars, while the Pennsylvania's plans are to purchase at least 6000 cars. The Erie and the Nickel Plate probably will come into the market in the next 30 days for about 3000 cars. Car equipment makers are reported to be supplied with enough work, if all pending business is placed, to keep them busy through the first quarter. The Southern Pacific has ordered 39 locomotives. Details of the week's activities follow:

The Van Sweringen interests have put out an inquiry for a total of 11,505 freight cars as follows: Chesapeake & Ohio, 1500 57½-ton gondolas, 1500 70-ton hoppers and 2000 50-ton box cars; Pere Marquette, 750 57½-ton gondolas, 250 70-ton gondolas, 1500 50-ton box, 2000 40-ton auto, 250 40-ton auto and furniture, 100 50-ton flat and 25 caboose cars; Hocking Valley, 1500 57½-ton gondolas. These roads also will be in the market soon for 146 passenger cars as follows: Chesapeake & Ohio, 20 passenger and baggage, 41 passenger, 6 mail and express cars; Pere Marquette, 8 passenger, 12 baggage and express; Hocking Valley, 4 passenger cars.

The Van Sweringen roads are asking for bids on the following locomotives: 25 freight and 50 switch locomotives for the Chesapeake & Ohio, 15 switch locomotives for the Pere Marquette and 25 freight and 15 switch locomotives for the Hocking Valley.

Southern Pacific has ordered 25 mallet type locomotives and 14 4-8-4 type locomotives from the Baldwin Locomotive Works.

Chicago Great Western has ordered 15 locomotives.

Southern has ordered 22 mail and baggage cars and one postal car from Bethlehem Steel Co.

Seaboard Air Line has ordered eight locomotives from Baldwin Locomotive Works.

Aliquippa & Southern is inquiring for one or two eight-wheel switching engines.

Reinforcing Steel

Awards Total 6600 Tons and Inquiries 2600 Tons

REINFORCING steel lettings in the past week totaled 6600 tons, of which 1200 tons will be required for a New York subway section and a like amount for the Ford assembly plant at Edgewater, N. J. New work which appeared for bids totaled 2600 tons. Awards follow:

NEW YORK, 1200 tons, Queens subway, route 108, section Nos. 3 and 4, to Concrete Steel Co.

EDGEWATER, N. J., 1200 tons, Ford Motor Co. assembly plant, to Truscon Steel Co.

CHICAGO, 600 tons, Mundelein College, to Calumet Steel Co.

BUFFALO, 180 tons, school No. 67, to a local bidder.

BUFFALO, 350 tons, floors for new City Hall, to a local bidder.

TACOMA, WASH., 800 tons, Eleventh Street viaduct, to an unnamed bidder.

OLYMPIA, WASH., 233 tons, Lake Union bridge, to an unnamed bidder.

SEATTLE, 200 tons, Fourteenth Avenue South bridge, to an unnamed bidder.

PORTLAND, ORE., 206 tons, Rogue River bridge, to an unnamed company.

SACRAMENTO, CAL., 356 tons, paving in Los Angeles County, to an unnamed company.

SANTA ANA, CAL., 267 tons, two bridges, to an unnamed company.

SACRAMENTO, 128 tons, San Luis Rey River bridge, to an unnamed bidder.

HONOLULU, 100 tons, paving work, to an unnamed bidder.

FLORENCE, ARIZ., 119 tons, cell house, to Soule Steel Co.

Reinforcing Bars Pending

Inquiries for reinforcing steel bars include the following:

CHICAGO, 200 tons, Fifty-seventh Street viaduct.

PHILADELPHIA, 680 tons, bridge at Henry Avenue; F. A. Canuso & Son, low bidder on general contract.

PHOENIX, ARIZ., 900 tons, Salt River bridge; bids Jan. 20.

GOLD BEACH, ORE., 838 tons, Rogue River bridge; bids Jan. 16.

SEATTLE, 250 tons, James Monroe School; bids opened.

SEATTLE, 200 tons, laboratory; bids opened.

SACRAMENTO, CAL., 137 tons, paving in Imperial County; bids Jan. 15.

Iron and Steel Markets

Steel Output Pointed Upward

Mill Operations Improve—Railroad and Structural Demand and Steady Scrap Market Are Features—Record in World Production

NINETEEN TWENTY-NINE will be remembered for 10 months of unprecedented production followed by the sharpest decline since that of December, 1907. Notwithstanding the drop in November and December, steel ingot output for the year, at 54,600,000 tons, exceeds the previous high total of 1928 by 8½ per cent.

The pressure for steel resulted in new records also in pig iron production. Lake shipments of iron ore and imports of iron ore, and, although no statistics are available, undoubtedly caused a peak consumption of scrap. Pig iron output, estimated at 42,700,000 tons, exceeded the previous high total, reached in 1923, by 5.8 per cent.

Of greater concern to the trade than these past performances are the prospects for the coming quarter. The last seven days of December saw ingot output at between 40 and 50 per cent of capacity, compared with 85 per cent a year ago, but improvement is already under way, and the current week will find production at 55 to 60 per cent in the Valleys, at 60 per cent at Chicago and 65 per cent at Pittsburgh.

The drastic deflation of buyers' stocks has caused mill operations to respond quickly to the resumption of activity among consuming industries following year-end inventory taking. Sheet and strip mill schedules are higher than they have been for some time and bar and tin plate mills are more active. Buying, however, is mainly in small lots for early requirements.

How rapidly steel output will recover is still a matter of conjecture, but producers find encouragement in the undiminished demands of the railroads, the structural steel industry and farm equipment manufacturers, and in fresh evidences of strength in the scrap market. Railroad freight cars now on inquiry total 19,000, including 11,500 for the Van Sweringen lines, and equipment builders are assured a high rate of operations throughout the first quarter. Rail bookings have been swelled by a Burlington purchase of 57,100 tons. Fabricated steel awards are moderately large, at 41,000 tons, and with lettings of 90,000 tons and 51,000 tons respectively in the two previous weeks, assure an unusually high December total.

The automotive industry continues to take more steel, although its orders are mainly for early needs and do not forecast more than a moderate increase in motor car production.

Finished steel prices show little change, despite pressure for concessions, especially by automobile builders. However, jobbing mills, under competition from wide strip mills, have lowered their quotations on blue annealed sheets, which now range from 2.10c. to 2.20c. for No. 10 gage and from 2.25c. to 2.35c. for No. 13 gage.

Pig iron contracting for the first quarter has not been in large volume except in the Chicago district. In sections where the automobile industry is a factor, melters will carry considerable iron over into the new year. On the other hand, shipping orders from the automotive foundries are increasing, indicating that they will use more iron in January than in November and December. Consumption of low phosphorus iron has risen in keeping with the expanding operations of steel foundries.

With about 11,500 freight cars and 130 locomotives soon to be inquired for by the Chesapeake & Ohio, Père Marquette and Hocking Valley, 3000 by the Erie and Nickel Plate, 1800 by the Louisville & Nashville and 1000 each by the Lehigh & New England and the Milwaukee road, the railroad equipment outlook is excellent. The 1930 program of the New York Central is said to call for 7000 cars, and the Pennsylvania will buy at least 6000. The week's orders included 39 locomotives for the Southern Pacific and 15 for the Chicago Great Western.

World steel output, estimated at 117,850,000 tons of steel ingots and castings, was 9 per cent larger than in 1928, when the previous record was made, and 60 per cent greater than in 1913. This country's share of the 1929 total, at 48 per cent, was the same as in the previous year.

World pig iron production, at 96,180,000 tons, was also a new record, and showed a gain of 24 per cent over the 1913 total.

Exports of iron and steel in November were 241,829 tons, a drop of more than 2 per cent from October and 7 per cent from November, 1928. In 11 months the total was 2,817,110 tons, the largest since 1920.

THE IRON AGE composite prices are unchanged at the year's lowest levels, finished steel at 2.362c. a lb. and pig iron at $18.21 a gross ton. Pig iron is 25c. lower and finished steel 58c. a net ton lower than a year ago.

A Comparison of Prices

Market Prices at Date, and One Week, One Month and One Year Previous. Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron, Per Gross Ton:	Dec. 30, 1929	Dec. 23, 1929	Dec. 3, 1929	Dec. 31, 1928
No. 2 fdy., Philadelphia	$20.76	$20.76	$21.26	$21.26
No. 2, Valley furnace	18.50	18.50	18.50	17.50
No. 2 Southern, Cincinnati	17.69	17.69	17.69	20.19
No. 2, Birmingham	14.50	14.50	14.50	16.50
No. 2 foundry, Chicago*	20.00	20.00	20.00	20.00
Basic, del'd eastern Pa.	19.50	19.50	19.75	19.75
Basic, Valley furnace	18.50	18.50	18.50	17.50
Valley Bessemer, del'd P'gh	20.76	20.76	20.76	20.01
Malleable, Chicago*	20.00	20.00	20.00	20.00
Malleable, Valley	19.00	19.00	19.00	18.00
Gray forge, Pittsburgh	19.76	19.76	19.76	18.76
L. S. charcoal, Chicago	27.04	27.04	27.04	27.04
Ferromanganese, furnace	100.00	100.00	100.00	105.00
Rails, Billets, etc., Per Gross Ton:				
Rails, heavy, at mill	$43.00	$43.00	$43.00	$43.00
Light rails at mill	36.00	36.00	36.00	36.00
Rerolling billets, Pittsburgh	34.00	34.00	35.00	33.00
Sheet bars, Pittsburgh	34.00	34.00	35.00	33.00
Slabs, Pittsburgh	34.00	34.00	35.00	33.00
Forging billets, Pittsburgh	39.00	39.00	40.00	38.00
Wire rods, Pittsburgh	40.00	40.00	40.00	42.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.85	1.85	1.85	1.90
Finished Steel,				
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.90	1.90	1.90	1.90
Bars, Chicago	2.00	2.00	2.00	2.00
Bars, Cleveland	1.90	1.90	1.90	1.90
Bars, New York	2.24	2.24	2.24	2.24
Tank plates, Pittsburgh	1.90	1.90	1.90	1.90
Tank plates, Chicago	2.00	2.00	2.00	2.00
Tank plates, New York	2.17½	2.17½	2.17½	2.17½
Structural shapes, Pittsburgh	1.90	1.90	1.90	1.90
Structural shapes, Chicago	2.00	2.00	2.00	2.00
Structural shapes, New York	2.09½	2.09½	2.09½	2.14½
Cold-finished bars, Pittsburgh	2.30	2.30	2.30	2.20
Hot-rolled strips, Pittsburgh	1.90	1.90	1.90	1.80
Cold-rolled strips, Pittsburgh	2.75	2.75	2.75	2.85

*The average switching charge for delivery to foundries in the Chicago district is 61c. per ton.

Finished Steel,	Dec. 30, 1929	Dec. 23, 1929	Dec. 3, 1929	Dec. 31, 1928
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Sheets, black, No. 24, P'gh	2.75	2.75	2.75	2.85
Sheets, black, No. 24, Chicago dist. mill	2.75	2.75	2.85	2.95
Sheets, galv., No. 24, P'gh	3.40	3.40	3.40	3.60
Sheets, galv., No. 24, Chicago dist. mill	3.50	3.50	3.50	3.70
Sheets, blue, No. 13, P'gh	2.25	2.35	2.35	2.10
Sheets, blue, No. 13, Chicago dist. mill	2.45	2.45	2.45	2.20
Wire nails, Pittsburgh	2.40	2.40	2.40	2.65
Wire nails, Chicago dist. mill	2.45	2.45	2.45	2.70
Plain wire, Pittsburgh	2.40	2.40	2.40	2.50
Plain wire, Chicago dist. mill	2.45	2.45	2.45	2.55
Barbed wire, galv., Pittsburgh	3.05	3.05	3.05	3.30
Barbed wire, galv., Chicago dist. mill	3.10	3.10	3.10	3.35
Tin plate, 100 lb. box, P'gh	$5.35	$5.35	$5.35	$5.35
Old Material, Per Gross Ton:				
Heavy melting steel, P'gh	$15.75	$15.75	$15.25	$18.75
Heavy melting steel, Phila.	14.50	14.50	14.50	16.00
Heavy melting steel, Chicago	12.50	12.50	12.50	14.75
Carwheels, Chicago	13.75	13.75	13.50	14.00
Carwheels, Philadelphia	*15.00*	15.50	15.50	16.50
No. 1 cast, Pittsburgh	14.50	14.50	14.50	16.00
No. 1 cast, Philadelphia	15.00	15.00	15.00	16.25
No. 1 cast, Ch'go (net ton)	13.50	13.50	13.50	15.75
No. 1 RR. wrot., Phila.	*15.00*	15.50	15.50	15.50
No. 1 RR. wrot., Ch'go (net)	12.00	12.00	12.00	13.25
Coke, Connellsville,				
Per Net Ton at Oven:				
Furnace coke, prompt	$2.60	$2.60	$2.65	$2.75
Foundry coke, prompt	3.75	3.75	3.75	3.75
Metals,				
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Lake copper, New York	18.12½	18.12½	18.12½	16.62½
Electrolytic copper, refinery	17.75	17.75	17.75	16.25
Tin (Straits), New York	*39.30*	39.50	39.37½	50.12½
Zinc, East St. Louis	5.45	5.45	6.00	6.35
Zinc, New York	5.80	5.80	6.35	6.70
Lead, St. Louis	6.10	6.10	6.10	6.35
Lead, New York	6.25	6.25	6.25	6.50
Antimony (Asiatic), N. Y.	*8.12½*	8.37½	8.62½	9.87½

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our market reports on other pages.

Pittsburgh

Automobile Industry Continues to Increase Steel Releases —Ingot Output Up to 65 Per Cent

PITTSBURGH, Dec. 30.—The holiday week brought little change in market conditions, except possibly an accentuation of tendencies which had become apparent earlier in the month. The automobile industry continues to increase its tonnage releases for early January shipment, and operating schedules in sheet and strip mills are higher this week than they have been for some time. Bar mills are also more active and tin plate production is gradually increasing.

Other steel lines are holding their own, with the result that open-hearth furnaces have been put on at nearly every mill in the district and steel ingot operations in the Pittsburgh vicinity are approximately 65 per cent of capacity as the new year begins. This is an increase of five to 10 points over the low levels reached in the last two weeks, as steel ingot production during December is not believed to have averaged much above 55 or 60 per cent.

The automobile industry is not the only one which promises gradual improvement as the first quarter progresses. The railroad equipment business continues active, with inquiry for approximately 11,500 freight cars by the Chesapeake & Ohio, the Pere Marquette and Hocking Valley; barge business is gaining momentum and the structural fabricators are now estimating the steel requirements for a Pittsburgh office building, which will take nearly 10,000 tons; farm implement and machinery makers are taking steel steadily and plan a good operation during the first half of the year.

Steel prices are being tested on contract business, and most of the consumers who take care of their requirements in this manner have signed first quarter contracts at unchanged prices. On large tonnages placed in the open market, there has been more question on price, notably on shapes for structural purposes, reinforcing bars and plates for the car builders. Sheets are holding fairly well in this territory, but shading in the East and in Detroit still gives the market a weak tone. The same might be said of strip steel, on which concessions have appeared on large tonnages.

Pig iron is still comparatively dull, although some buying is reported and prices were given a test last week with the placing of foundry and Bessemer iron for first quarter by a local foundry at the full quoted schedules.

Scrap is holding at last week's levels and is given a firm tone by the efforts of small dealers to get good prices for the steel they have to ship against present mill contracts.

Semi-Finished Steel.—Buyers of crude steel in this district are showing little interest in their first quarter requirements, but a considerable amount of material contracted for during this quarter has not been specified, and integrated steel producers will not need to make further commitments until January is well along. Pittsburgh sellers have made no official first quarter price announcement, but are willing to take business at $34, Pittsburgh or Youngstown. On forging billets, a few contracts have been made at $40, but the market is expected to settle to the usual $5 premium over rerolling billets. Users of wire rods are beginning to show increasing interest in their January requirements and specifications for shipment during that month have improved in the week. The wire rod price is holding at $40, Pittsburgh or Cleveland.

Pig Iron.—Buying is still confined to small lots, although consumers in this territory continue to show added in-

terest in their first quarter requirements. The Westinghouse Electric & Mfg. Co. has closed against the first quarter requirements of its Cleveland and Trafford City plants, and the business was divided among a number of producers. On the Trafford City iron, the full quoted prices of $18.50, Valley, for foundry iron, and $19 for Bessemer were received. Under the circumstances, the market enters the new year with quotations unchanged and with production at a low point. Shipping orders against old contracts are more numerous this week, and are expected to improve gradually as the month progresses.

Prices per gross ton, f.o.b. Valley furnace:

Basic	$18.50
Bessemer	19.00
Gray forge	18.00
No. 2 foundry	18.50
No. 3 foundry	18.00
Malleable	19.00
Low phos., copper free	27.00

Freight rate to Pittsburgh or Cleveland district, $1.76.

Prices per gross ton, f.o.b. Pittsburgh district furnace:

Basic	$19.00
No. 2 foundry	19.00
No. 3 foundry	18.50
Malleable	19.50

Freight rates to points in Pittsburgh district range from 63c. to $1.13.

Bars, Shapes and Plates.—Specifications were light last week, but this was to have been expected in view of the mid-week holiday. However, tonnage releases for the early weeks of January are improving, and steel makers are viewing with satisfaction the accumulation of inquiries and orders for a wide range of products and materials which will take heavy steel tonnages. Announcement of probable 1930 expenditures by the Van Sweringen railroads is gratifying, and formal inquiry is expected at an early date for the 11,500 freight cars and 130 locomotives which have been authorized. The authorization also includes 301 items of passenger train equipment. Freight cars on order are already very large and business in sight from this source is certain to provide a heavy outlet for steel during the first half of the new year. The barge business is also showing life, 12 barges let last week calling for 1850 tons of steel. Bids will be taken by the United States Engineer, Rock Island, Ill., on Jan. 3 for 20 barges, which will require 1300 tons. The Gulf Oil Building in Pittsburgh is also reaching the point of interest from a steel standpoint, with the required tonnage estimated at from 8000 to 10,000 tons. Prices on the heavy hot-rolled products are essentially unchanged, but a growing number of contract customers are placing their first quarter business and price concessions occur only on special transactions. The 1.90c., Pittsburgh, price now seems destined to be the ruling figure on the general run of business in the new year.

Rails and Track Supplies.—The year will end with only a few of the country's leading railroads not under commitments on their rail requirements and with the local mill better supplied with forward tonnage than it was a year ago. Fairly heavy tonnage of track accessories have been specified for shipment in the first two weeks of January.

Tubular Goods.—The pipe business continues quiet, and, with many units closed down all last week, operations declined sharply in this and the Valley districts. Welded pipe is seasonally dull and demand for seamless is not much better. Specifications for mechanical tubing are improving slightly. Boiler tubing is moving steadily.

Wire Products.—By Jan. 10 all of the low-priced nail business now on producers' books will be specified or cancelled, and first quarter contracts placed in the last two weeks have generally been at $2.40 to $2.50 a keg, Pittsburgh, in this district. Demand for wire from the jobbing trade is seasonally dull. Orders from the manufacturing trade are improving only slightly. On this business, the price is holding at 2.40c., Pittsburgh.

Sheets. — Automobile tonnage is reaching mills in increasing volume, and rolling schedules in this and nearby districts, which were very light last week, are expected to show a sharp increase as the new year begins. Business from this source is by no means large, but even light tonnage is an improvement over the negligible amounts of the last few weeks. Other sheet consuming lines will also improve in January, and most producers view the new year with increasing confidence. The price situation is no worse, despite continued reports of weakness in the East. Some Michigan buyers have also received concessions, but sheet makers have no intention of recognizing a lower price level at a time when business seems to be at the point of improvement.

Tin Plate.—The closing days of the year have brought slightly heavier specifications, and some mills are now able to plan a fairly steady operating rate for two or three weeks. This is a natural seasonal improvement over the last two months, when mill schedules were not determined until the end of the preceding week. Operations were interrupted by the holiday last week, but are now at about a 70 per cent rate for the industry as a whole.

Strip Steel.—Strip makers are receiving improved automotive tonnage and began the week with considerably better operating schedules than they have had for some time. December shipments declined from the previous month's total, but new business was better than in November. Prices are unchanged and improving business is giving the market more strength than it has had in recent weeks.

Coke.—The coke business is no better. Sales are principally in carload lots. Production of furnace coke continues to decline, but not so rapidly as consumption, and distress material is still a market factor. The price on this grade is not yet quotable at less than $2.60, Connellsville, although any considerable tonnage might command a better quotation. Heating coke is moving fairly well, but prices lack firmness. Shipments of foundry coke are expected to improve this week.

Old Material.—The scrap market retains its strength, and sellers are meeting with increasing difficulty in covering against recent $15.50 orders for heavy melting steel at local mills. This price is being offered freely by local dealers, and in some instances higher figures have been paid. Following a reported sale last week at $16, sellers of scrap are less willing to quote this price to mills for any substantial tonnage, and the new month is expected to see a continued upward swing in old material quota-

The Iron Age Composite Prices

Finished Steel

Dec. 30, 1929, 2.362c. a Lb.

One week ago	2.362c.
One month ago	2.362c.
One year ago	2.391c.
10-year pre-war average	1.689c.

Based on steel bars, beams, tank plates, wire, rails, black pipe and black sheets. These products make 87 per cent of the United States output of finished steel.

	High	Low
1929	2.412c., April 2;	2.362c., Oct. 29
1928	2.391c., Dec. 11;	2.314c., Jan. 3
1927	2.453c., Jan. 4;	2.293c., Oct. 25
1926	2.453c., Jan. 5;	2.403c., May 18
1925	2.560c., Jan. 6;	2.396c., Aug. 18

Pig Iron

Dec. 30, 1929, $18.21 a Gross Ton

One week ago	$18.21
One month ago	18.29
One year ago	18.46
10-year pre-war average	15.72

Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

	High	Low
1929	$18.71, May 14;	$18.21, Dec. 17
1928	18.59, Nov. 27;	17.04, July 24
1927	19.71, Jan. 4;	17.54, Nov. 1
1926	21.54, Jan. 5;	19.46, July 13
1925	22.50, Jan. 13;	18.96, July 7

Mill Prices of Finished Iron and Steel Products

Iron and Steel Bars

Soft Steel

	Base per Lb.
F.o.b. Pittsburgh mill	1.90c.
F.o.b. Chicago	2.00c.
Del'd Philadelphia	2.22c.
Del'd New York	2.24c.
Del'd Cleveland	1.85c. to 1.90c.
F.o.b. Cleveland	1.85c. to 1.90c.
F.o.b. Lackawanna	2.00c.
F.o.b. Birmingham	2.10c.
C.i.f. Pacific ports	2.35c.
F.o.b. San Francisco mills	2.35c.

Billet Steel Reinforcing

F.o.b. Pittsburgh mills, 40, 50, 60-ft.	2.00c.
F.o.b. Pittsburgh mills, cut lengths	2.25c.
F.o.b. Birmingham, mill lengths	2.10c.

Rail Steel

F.o.b. mills, east of Chicago dist.	1.90c.
F.o.b. Chicago Heights mill	1.90c.
Del'd Philadelphia	2.27c.

Iron

Common iron, f.o.b. Chicago	2.00c.
Refined iron, f.o.b. P'gh mills	2.75c.
Common iron, del'd Philadelphia	2.12c.
Common iron, del'd New York	2.14c.

Tank Plates

	Base per Lb.
F.o.b. Pittsburgh mill	1.90c.
F.o.b. Chicago	2.00c.
F.o.b. Birmingham	2.05c.
Del'd Cleveland	2.09c.
Del'd Philadelphia	2.10c. to 2.15c.
F.o.b. Coatesville	2.00c. to 2.05c.
F.o.b. Sparrows Point	2.00c. to 2.05c.
F.o.b. Lackawanna	2.00c. to 2.05c.
Del'd New York	2.17½c. to 2.22½c.
C.i.f. Pacific ports	2.25c. to 2.35c.

Structural Shapes

	Base per Lb.
F.o.b. Pittsburgh mill	1.90c.
F.o.b. Chicago	2.00c.
F.o.b. Birmingham	2.05c.
F.o.b. Lackawanna	2.00c. to 2.05c.
F.o.b. Bethlehem	2.00c.
Del'd Cleveland	2.09c.
Del'd Philadelphia	1.96c. to 2.06c.
Del'd New York	2.09½c. to 2.14½c.
C.i.f. Pacific ports	2.35c.

Hot-Rolled Hoops, Bands and Strips

	Base per Lb.
6 in. and narrower, P'gh	2.00c.
Wider than 6 in., P'gh	1.90c.
6 in. and narrower, Chicago	2.10c.
Wider than 6 in., Chicago	2.00c.
Cooperage stock, P'gh	2.20c.
Cooperage stock, Chicago	2.30c.

Cold-Finished Steel

	Base per Lb.
Bars, f.o.b. Pittsburgh mill	2.20c.
Bars, f.o.b. Chicago	2.20c.
Bars, Cleveland	2.20c.
Bars, Buffalo	2.20c.
Shafting, ground, f.o.b. mill	*2.55c. to 3.50c.
Strips, P'gh	2.75c.
Strips, Cleveland	2.75c.
Strips, del'd Chicago	3.05c.
Strips, Worcester	2.90c.
Fender stock, No. 20 gage, Pittsburgh or Cleveland	4.25c.

*According to size.

Wire Products

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Merchant Trade

	Base per Keg
Standard wire nails	$2.40 to $2.50
Cement coated nails	2.40 to 2.50
Galvanized nails	4.40 to 4.50

	Base per Lb.
Polished staples	2.85c. to 2.95c.
Galvanized staples	3.10c. to 3.20c.
Barbed wire, galvanized	3.05c. to 3.15c.
Annealed fence wire	2.55c. to 2.65c.
Galvanized wire, No. 9	3.00c. to 3.10c.
Woven wire fence (per net ton to retailers)	$65.00

To Manufacturing Trade

Bright hard wire, Nos. 6 to 9 gage	2.40c.
Spring wire	3.50c.

(Carload lots, f.o.b. Chicago.)

Wire nails	$2.45 to $2.55 (keg)
Annealed fence wire	2.60c. to 2.70c. (lb.)
Bright hard wire to manufacturing trade	2.45c.

Anderson, Ind., mill prices are ordinarily $1 a ton over Pittsburgh base; Duluth, Minn., mill $2 a ton over Pittsburgh, and Birmingham mill $3 a ton over Pittsburgh.

Cut Nails

	Per 100 Lb.
Carloads, Wheeling, Reading or Northumberland, Pa.	$2.70
Less carloads, Wheeling or Reading	2.80

Light Plates

No. 10, blue annealed, f.o.b. P'gh	2.10c. to 2.20c.
No. 10, blue annealed, f.o.b. Chicago dist.	2.30c.
No. 10, blue annealed, del'd Phila.	2.42c. to 2.52c.
No. 10, blue annealed, B'ham	2.35c.

Sheets

Blue Annealed

	Base per Lb.
No. 13, f.o.b. P'gh	2.25c. to 2.35c.
No. 13, f.o.b. Chicago dist.	2.45c.
No. 13, del'd Philadelphia	2.57c. to 2.67c.
No. 13, blue annealed, B'ham	2.50c.

Box Annealed, One Pass Cold Rolled

No. 24, f.o.b. Pittsburgh	2.75c.
No. 24, f.o.b. Chicago dist. mill	2.75c. to 2.85c.
No. 24, del'd Philadelphia	3.07c.
No. 24, f.o.b. Birmingham	3.00c. to 3.10c.

Metal Furniture Sheets

No. 24, f.o.b. P'gh	4.00c.

Galvanized

No. 24, f.o.b. Pittsburgh	3.40c. to 3.50c.
No. 24, f.o.b. Chicago dist. mill	3.50c. to 3.60c.
No. 24, del'd Cleveland	3.59c. to 3.69c.
No. 24, del'd Philadelphia	3.72c. to 3.82c.
No. 24, f.o.b. Birmingham	3.65c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.90c. to 3.00c.
No. 28, f.o.b. Chicago dist. mill	3.00c. to 3.10c.

Automobile Body Sheets

No. 20, f.o.b. Pittsburgh	3.90c. to 4.00c.

Long Ternes

No. 24, 8-lb. coating, f.o.b. mill	3.90c. to 4.00c.

Vitreous Enameling Stock

No. 24, f.o.b. Pittsburgh	3.90c.

Tin Plate

	Per Base Box
Standard cokes, f.o.b. P'gh district mills	$5.35
Standard cokes, f.o.b. Gary	5.45

Terne Plate

(*F.o.b. Morgantown or Pittsburgh*)
(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.70
15-lb. coating I.C.	13.40
20-lb. coating I.C.	14.60
25-lb. coating I.C.	$15.90
30-lb. coating I.C.	16.80
40-lb. coating I.C.	18.80

Alloy Steel Bars

(F.o.b. makers' mill)

Alloy Quality Bar Base, 2.65c. per Lb.

S.A.E. Series Numbers		Alloy Differential
2000	(1½% Nickel)	$0.25
2100	(1¼% Nickel)	0.55
2300	(3½% Nickel)	1.50
2500	(5% Nickel)	2.25
3100	Nickel Chromium	0.55
3200	Nickel Chromium	1.35
3300	Nickel Chromium	3.80
3400	Nickel Chromium	3.20
4100	Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100	Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600	Nickel Molybdenum (0.20 to 0.30 Molybdenum, 1.25 to 1.75 Nickel)	1.05
5100	Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100	Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100	Chromium Spring Steel	0.20
6100	Chromium Vanadium Bars	1.20
6100	Chromium Vanadium Spring Steel	0.95
9250	Silicon Manganese Spring Steel (flats)	0.25
	Rounds and squares	0.50
	Chromium Nickel Vanadium	1.50
	Carbon Vanadium	0.95

Above prices are for hot rolled steel bars, forging quality. The differential for cold-drawn bars is ¾c. a lb. higher, with standard classification for cold-finished alloy steel bars applying. For billets 4 x 4 to 10 x 10 in., the price for a gross ton is the net price for bars of the same analysis.

Billets under 4 x 4 in. carry the steel bar base. Slabs with a sectional area of 16 in. or over carry the billet price. Slabs with sectional area of less than 16 in. or less than 2½ in. thick, regardless of sectional area, take the bar price.

Rails

	Per Gross Ton
Standard, f.o.b. mill	$43.00
Light (from billets), f.o.b. mill	36.00
Light (from rail steel), f.o.b. mill	34.00
Light (from billets), f.o.b. Ch'go mill	36.00

Track Equipment

	Base per 100 Lb.
Spikes, ⅝ in. and larger	$2.80
Spikes, ½ in. and smaller	2.80
Spikes, boat and barge	3.00
Tie plate, steel	2.15
Angle bars	$2.75
Track bolts, to steam railroads	$3.80 to 4.00
Track bolts, to jobbers, all sizes, per 100 count	70 per cent off list

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

Butt Weld

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
⅛	45	19½	¼ and ⅜	+11	+36
¼ to ⅜	51	25½	½	23	5
½	56	42½	¾	28	11
¾	60	48½	1 and 1¼	31	15
1 to 3	62	50½	1½ and 2	35	18

Lap Weld

2	55	43½	2	23	9
2½ to 6	59	47½	2½ to 3½	28	13
7 and 8	56	43½	4 to 6	30	17
9 and 10	54	42½	7 and 8	29	16
11 and 12	53	40½	9 to 12	26	11

Butt Weld, extra strong, plain ends

⅛	41	24½	¼ and ⅜	+13	+48
¼ to ⅜	47	30½	½	23	7
½	53	42½	¾	25	12
¾	58	47½	1 to 2	34	18
1 to 1½	60	49½			
2 to 3	61	50½			

Lap Weld, extra strong, plain ends

2	53	42½	½	29	13
2½ to 4	57	46½	2½ to 4	34	29
4½ to 6	56	45½	4½ to 6	33	19
7 to 8	52	39½	7 and 8	31	17
9 and 10	45	32½	9 to 12	21	8
11 and 12	44	31½			

On carloads the above discounts on steel pipe are increased on black by one point, with supplementary discount of 5%, and on galvanized by 1½ points, with supplementary discount of 5%. On iron pipe, both black and galvanized, the above discounts are increased to jobbers by one point with supplementary discounts of 5 and 2½%.

Note.—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Base Discounts, f.o.b. Pittsburgh

Steel		Charcoal Iron	
2 in. and 2¼ in.	38	1½ in.	1
2½ in.—2¾ in.	46	1¾ in.	8
3 in.	52	2 in.—2¼ in.	13
3¼ in.—3¾ in.	54	2½ in.—2¾ in.	16
4 in.	57	3 in.	17
4½ in. to 6 in.	46	3¼ in. to 3½ in.	18
		4 in.	20
		4½ in.	21

On lots of a carload or more, the above base discounts are subject to a preferential of two fives on steel and of 10 per cent on charcoal iron tubes. Smaller quantities are subject to the following modifications from the base discounts:

Lap Welded Steel—Under 10,000 lb., 6 points under base and one five; 10,000 lb. to carload, 4 points under base and two fives. Charcoal Iron—Under 10,000 lb., 2 points under base; 10,000 lb. to carload, base and one five.

Standard Commercial Seamless Boiler Tubes

Cold Drawn

1 in.	61	3 in.	46
1¼ to 1½ in.	53	3½ to 3½ in.	48
1¾ in.	37	4 in.	51
2 to 2¼ in.	32	4½, 5 and 6 in.	40
2½ to 2¾ in.	40		

Hot Rolled

2 and 2¼ in.	38	3¼ to 3½ in.	54
2½ and 2¾ in.	46	4 in.	57
3 in.	52	4½, 5 and 6 in.	46

Beyond the above base discounts a preferential discount of 5 per cent is allowed on carload lots. On less than carloads to 10,000 lb., base discounts are reduced 4 points with 5 per cent preferential; on less than 10,000 lb., base discounts are reduced 6 points, with no preferential. No extra for lengths up to and including 24 ft. Sizes smaller than 1 in. and lighter than standard gage take the mechanical tube list and discounts. Intermediate sizes and gages not listed take price of next larger outside diameter and heavier gage.

Seamless Mechanical Tubing

	Per Cent Off List
Carbon, 0.10% to 0.30%, base (carloads)	55
Carbon, 0.30% to 0.40% base	50

Plus differentials for lengths over 18 ft. and for commercial exact lengths. Warehouse discounts on small lots are less than the above.

tions. Hydraulic compressed sheets are stronger, and sales at Detroit have been at such high prices that this steel can hardly move into the Pittsburgh district. No. 2 heavy melting steel is moving freely to one point, with dealers paying up to $14.50 to cover against recent orders. The other grades are substantially unchanged, with specialties strong, and little or no market for the lighter grades. Sales of sheet bar crops have been made at close to $18.50.

Prices per gross ton delivered consumers' yards in Pittsburgh and points taking the Pittsburgh district freight rate:

Basic Open-Hearth Grades:	
No. 1 heavy melting steel	$15.50 to $16.00
No. 2 heavy melting steel	14.50 to 15.00
Scrap rails	14.00 to 14.50
Compressed sheet steel	15.50 to 16.00
Bundled sheets, sides and ends	14.00 to 14.50
Cast iron carwheels	14.00 to 14.50
Sheet bar crops, ordinary	18.00 to 18.50
Heavy breakable cast	11.50 to 12.00
No. 2 railroad wrought	15.50 to 16.00
Hvy. steel axle turnings	14.00 to 14.50
Machine shop turnings	10.00 to 10.50
Acid Open-Hearth Grades:	
Railr. knuckles and couplers	20.00 to 20.50
Railr. coil and leaf springs	20.00 to 20.50
Rolled steel wheels	20.00 to 20.50
Low phos. billet and bloom ends	20.50 to 21.00
Low phos., mill plates	20.50 to 21.00
Low phos., light grades	19.50 to 20.50
Low phos., sheet bar crops	20.50 to 21.00
Heavy steel axle turnings	14.00 to 14.50
Electric Furnace Grades:	
Low phos., punchings	18.50 to 19.00
Hvy. steel axle turnings	14.00 to 14.50
Blast Furnace Grades:	
Short shoveling steel turnings	10.50 to 11.00
Short mixed borings and turnings	10.50 to 11.00
Cast iron borings	10.50 to 11.00
Rolling Mill Grades:	
Steel car axles	19.50 to 20.50
Cupola Grades:	
No. 1 cast	14.00 to 15.00
Rails 3 ft. and under	17.50 to 18.50

The Ohio Electric & Controller Co., Cleveland, will hold its annual sales conference in Cleveland, Jan. 13 to 17. The conference will be attended by all of the company's motor and magnet representatives in the United States.

Warehouse Prices, f.o.b. Pittsburgh

	Base per Lb.
Plates	3.00c.
Structural shapes	3.00c.
Soft steel bars and small shapes	2.90c.
Reinforcing steel bars	2.75c.
Cold-finished and screw stock—	
Rounds and hexagons	3.60c.
Squares and flats	4.10c.
Bands	3.25c.
Hoops	4.25c.
Black sheets (No. 24), 25 or more bundles	3.70c. to 3.80c
Galv. sheets (No. 24), 25 or more bundles	4.35c. to 4.45c.
Light plates, blue annealed (No. 10), 1 to 24 plates	3.25c. to 3.35c.
Blue annealed sheets (No. 13), 1 to 24 sheets	3.40c. to 3.50c.
Galv. corrug. sheets (No. 28), per square	$4.33
Spikes, large	3.40c.
Small	3.80c. to 5.25c.
Boat	3.80c.
Track bolts, all sizes, per 100 count	60 per cent off list
Machine bolts, 100 count	60 per cent off list
Carriage bolts, 100 count	60 per cent off list
Nuts, all styles, 100 count	60 per cent off list
Large rivets, base per 100 lb.	$3.50
Wire, black soft ann'l'd, base per 100 lb.	$2.90 to 3.00
Wire, galv. soft, base per 100 lb.	2.90 to 3.00
Common wire nails, per keg	2.80 to 2.90
Cement coated nails, per keg	2.95 to 3.05

Chicago

Steel Mills at 60 Per Cent of Capacity — Orders Barely Sufficient to Support This Rate

CHICAGO, Dec. 30.—Chicago district mills closed 1929 with shipments representing 60 per cent of ingot capacity, the lowest rate of 1929. Deliveries in the week were in excess of the output of steel mill pig iron, which accumulated in the week previous, when storms kept men from work and tied up mill and railroad transportation. The accumulation of pig iron at that time has led the foremost producer to bank a furnace at Gary and the stack at Joliet, both of which it is planned to bring back in service the first Monday in the new year. The year closes with 20 steel mill stacks active of 36 in the district. A year ago ingot output was at 85 per cent of capacity. Order books were heavy and specifications more than supported the then current rate of production. The closing of 1929 finds releases for steel barely able to support output, and new buying at an unusually low point.

Pig Iron.—Total shipments of Northern iron for the year fall short of the 1926 record by a fraction of 1 per cent. The new year starts with all merchant stacks lighted, though it is probable that one may soon have to go down for repairs. Shipments do not match with production, and stocks at furnaces continue to grow. Forward buying at $20 a ton, local furnace, the price which has held throughout the year, has gained rapid headway in the past 10 days. The result is that Chicago furnaces are now booked for first quarter to about 80 per cent of capacity. December shipments showed no recession from the November rate and, with releases growing more numerous, it is anticipated by sellers that the January total will be larger than that of the closing month of 1929. A melter at South Bend, Ind., has closed for 2000 tons of iron for delivery in January and February. The old year closed with four charcoal stacks in blast.

Prices per gross ton at Chicago:

N'th'n No. 2 fdy., sil. 1.75 to 2.25	$20.00
N'th'n No. 1 fdy., sil. 2.25 to 2.75	20.50
Malleable, not over 2.25 sil.	20.00
High phosphorus	20.00
Lake Super. charcoal, sil. 1.50	27.04
So'th'n No. 2 fdy. (all rail)	$19.01 to 19.51
Low phos., sil. 1 to 2, copper free	29.50
Silvery, sil. 8 per cent	$28.79 to 29.79
Bess. ferrosilicon, 14-15 per cent	46.29

Prices are delivered consumers' yards except on Northern foundry, high phosphorus and malleable, which are f.o.b. local furnace, not including an average switching charge of 61c. per gross ton.

Ferroalloys.—This market is quiet except for occasional spot orders. Spiegeleisen is moving at $34 a ton, Hazard, Pa., in carloads and at $33 for orders up to 150 tons each.

Reinforcing Bars.—This market is marking time both as to inquiries and new contracts. Cold weather and lack of new orders have combined to reduce bending shop operations, which have been cut to 35 per cent of capacity. It is reported that an effort will be made to establish 2.45c. a lb. as the base price for billet steel reinforcing bars out of Chicago warehouses on lots under 30 tons each and 2.85c. for orders of less than five tons each.

Bars.—Specifications for mild steel bars show further growth as automobile parts manufacturers and farm implement builders launch heavier production programs. Prices for this commodity remain steady at 2c. a lb., Chicago, on sales that are far below the volume usually expected at the end of a quarter. Automobile manufacturers are ordering larger quantities of alloy steel bars and producers are prepared to increase output soon after the first of the year. The iron bar market is quiet. Rail steel bar mills are holding to a steady rate of output, and backlogs are growing lighter in the absence of volume buying.

Plates.—Demand for plates for tank construction in the Southwest remains active, with purchases in the past week totaling 1800 tons and fresh inquiries reaching 5000 tons. The Chesapeake & Ohio, with its subsidiaries, is in the market for about 11,350 freight cars. A large part of these are of all steel construction, and it is estimated that, with wheels and axles, these cars, about 50 per cent of which may be built in the West, will call for 200,000 tons of steel. Estimates place the total number of freight cars now on inquiry at 19,000.

Structural Material.—Formal signing of contracts is all that is now necessary to place in shops the 3500 tons of steel to be fabricated for the Wabash Avenue bridge, Chicago. Fabricators find that 1929 has been satisfactory from the viewpoint of

Warehouse Prices, f.o.b. Chicago

	Base per Lb.
Plates and structural shapes	3.10c.
Soft steel bars	3.00c.
Reinforc'g bars, billet steel	1.95c. to 2.10c.
Reinforc'g bars, rail steel	1.80c.
Cold-fin. steel bars and shafting—	
Rounds and hexagons	3.60c.
Flats and squares	4.10c.
Bands (¼ in. in Nos. 10 and 12 gages)	3.20c.
Hoops (No. 14 gage and lighter)	3.75c.
Black sheets (No. 24)	4.05c.
Galv. sheets (No. 24)	4.90c.
Blue ann'l'd sheets (No. 10)	3.35c.
Spikes, ⅜ in. and larger	3.55c.
Track bolts	4.55c.
Rivets, structural	4.00c.
Rivets, boiler	4.00c.
	Per Cent Off List
Machine bolts	60
Carriage bolts	60
Coach or lag screws	60
Hot-pressed nuts, sq., tap. or blank	60
Hot-pressed nuts, hex., tap. or blank	60
No. 8 black ann'l'd wire, per 100 lb.	$3.45
Com. wire nails, base per keg	$2.75 to 2.95
Cement c't'd nails, base per keg	2.75 to 2.95

Semi-Finished Steel, Raw Materials, Bolts and Rivets

Mill Prices of Semi-Finished Steel

Billets and Blooms

	Per Gross Ton
Rerolling, 4-in. and under 10-in., Pittsburgh	$34.00
Rerolling, 4-in. and under 10-in., Youngstown	34.00
Rerolling, 4-in. and under 10-in., Cleveland	34.00
Rerolling, 4-in. and under 10-in., Chicago	36.00
Forging quality, Pittsburgh	39.00

Sheet Bars

(Open Hearth or Bessemer)

	Per Gross Ton
Pittsburgh	$34.00
Youngstown	34.00
Cleveland	34.00

Slabs

(8 in. x 2 in. and under 10 in. x 10 in.)

	Per Gross Ton
Pittsburgh	$34.00
Youngstown	34.00
Cleveland	34.00

Skelp

(F.o.b. Pittsburgh or Youngstown)

	Per Lb
Grooved	1.85c. to 1.90c.
Universal	1.85c. to 1.90c.
Sheared	1.85c. to 1.90c.

Wire Rods

(Common soft, base)

	Per Gross Ton
Pittsburgh	$40.00
Cleveland	40.00
Chicago	41.00

Prices of Raw Material

Ores

Lake Superior Ores, Delivered Lower Lake Ports

	Per Gross Ton
Old range Bessemer, 51.50% iron	$4.80
Old range non-Bessemer, 51.50% iron	4.65
Mesabi Bessemer, 51.50% iron	4.65
Mesabi non-Bessemer, 51.50% iron	4.50
High phosphorus, 51.50% iron	4.40

Foreign Ore, c.i.f. Philadelphia or Baltimore

	Per Unit
Iron ore, low phos., copper free, 55 to 58% iron in dry Spanish or Algerian	12.00c.
Iron ore, low phos., Swedish, average 68% iron	12.00c.
Iron ore, basic Swedish, average 65% iron	10.00c.
Manganese ore, washed, 52% manganese, from the Caucasus	30.00c.
Manganese ore, Brazilian, African or Indian, basic 50%	30.00c.
Tungsten ore, high grade, per unit, in 60% concentrates	$15.25 to $16.50
	Per Gross Ton
Chrome ore, 45 to 50% Cr_2O_3, crude, c.i.f. Atlantic seaboard	$22.00 to $24.00
	Per Lb.
Molybdenum ore, 85% concentrates of MoS_2, delivered	50c. to 55c.

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville prompt	$2.60 to $2.75
Foundry, f.o.b. Connellsville prompt	3.75 to 4.75
Foundry, by-product, Ch'go ovens	8.00
Foundry, by-product, New England, del'd	11.00
Foundry, by-product, Newark or Jersey City, delivered	9.00 to 9.40
Foundry, by-product, Phila.	9.00
Foundry, Birmingham	5.00
Foundry, by-product, St. Louis, f.o.b. ovens	8.00
Foundry by-prod., del'd St. Louis	9.00

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.25 to $1.75
Mine run coking coal, f.o.b. W. Pa. mines	1.50 to 1.75
Gas coal, ¾-in. f.o.b. Pa. mines	1.90 to 2.00
Mine run gas coal, f.o.b. Pa. mines	1.65 to 1.75
Steam slack, f.o.b. W. Pa. mines	80c. to 90c.
Gas slack, f.o.b. W. Pa. mines	1.00 to 1.10

Ferromanganese

	Per Gross Ton
Domestic, 80%, seaboard	$100.00
Foreign, 80%, Atlantic or Gulf port, duty paid	100.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$31.00 to $34.00
Domestic, 16 to 19%	29.00 to 32.00

Electric Ferrosilicon

Per Gross Ton Delivered

50%	$83.50
75%	130.00

Per Gross Ton Furnace		Per Gross Ton Furnace	
10%	$35.00	12%	$39.00
11%	37.00	14 to 16%	45.00

Bessemer Ferrosilicon

F.o.b. Jackson County, Ohio, Furnace

Per Gross Ton		Per Gross Ton	
10%	$30.00	12%	$34.00
11%	32.00		

Silvery Iron

F.o.b. Jackson County, Ohio, Furnace

Per Gross Ton		Per Gross Ton	
6%	$22.00 to $23.00	10%	$26.00 to $28.00
7%	23.00 to 24.00	11%	28.00 to 30.00
8%	24.00 to 25.00	12%	30.00 to 32.00
9%	25.00 to 26.00		

Other Ferroalloys

Ferrotungsten, per lb. contained metal del'd	$1.40 to $1.50
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr., per lb. contained Cr. delivered, in carloads	11.00c.
Ferrovanadium, per lb. contained vanadium, f.o.b. furnace	$3.15 to $3.65
Ferrocarbontitanium, 15 to 18%, per net ton, f.o.b. furnace, in carloads	$160.00
Ferrophosphorus, electric or blast furnace material, in carloads, 18%, Rockdale, Tenn., base, per gross ton	$91.00
Ferrophosphorus, electric 24%, f.o.b. Anniston, Ala., per gross ton	$122.50

Fluxes and Refractories

Fluorspar

	Per Net Ton
Domestic, 85% and over calcium fluoride, not over 5% silicon, gravel, f.o.b. Illinois and Kentucky mines	$18.00
No. 2 lump, Illinois and Kentucky mines	20.00
Foreign, 85% calcium fluoride, not over 5% silica, c.i.f. Atlantic port, duty paid	$18.25 to 18.75
Domestic, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silica, f.o.b. Illinois and Kentucky mines	32.50

Fire Clay Brick

Per 1000 f.o.b. Works

	High-Heat Duty Brick	Intermediate Heavy Duty Brick
Pennsylvania	$43.00 to $46.00	$35.00 to $38.00
Maryland	43.00 to 46.00	35.00 to 38.00
New Jersey	50.00 to 65.00	.....
Ohio	43.00 to 46.00	35.00 to 38.00
Kentucky	43.00 to 46.00	35.00 to 38.00
Missouri	43.00 to 46.00	35.00 to 38.00
Illinois	43.00 to 46.00	35.00 to 38.00
Ground fire clay, per ton	7.00	

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$43.00
Chicago	52.00
Birmingham	50.00
Silica clay, per ton	$8.50 to 10.00

Magnesite Brick

	Per Net Ton
Standard sizes, f.o.b. Baltimore and Chester, Pa.	$65.00
Grain magnesite, f.o.b. Baltimore and Chester, Pa.	40.00
Standard size	45.00

Chrome Brick

	Per Net Ton
Standard size	$45.00

Mill Prices of Bolts, Nuts, Rivets and Set Screws

Bolts and Nuts

Per 100 Pieces

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
†Machine bolts	70
†Carriage bolts	70
Lag bolts	70
Plow bolts, Nos. 1, 2, 3 and 7 heads	70
Hot-pressed nuts, blank or tapped, square	70
Hot-pressed nuts, blank or tapped, hexagons	70
C.p.c. and t. square or hex. nuts, blank or tapped	70
Washers*	7.00c. to 6.75c. per lb. off list

*F.o.b. Chicago, New York and Pittsburgh.

†Bolts with rolled thread up to and including ¼ in. x 6 in. take 10 per cent lower list prices.

Bolts and Nuts

	Per Cent Off List
Semi-finished hexagon nuts	70
Semi-finished hexagon castellated nuts, S.A.E.	70
Stove bolts in packages, P'gh.	75, 20, 10 and 5
Stove bolts in packages, Chicago.	75, 20, 10 and 5
Stove bolts in packages, Cleveland.	75, 20, 10 and 5
Stove bolts in bulk, P'gh.	75, 20, 10, 5 and 2½
Stove bolts in bulk, Chicago.	75, 20, 10, 5 and 2½
Stove bolts in bulk, Cleveland.	75, 20, 10, 5 and 2½
Tire bolts	60, 5 and 5

Discounts of 70 per cent off on bolts and nuts applied on carload business. For less than carload orders discounts of 55, 60 per cent apply.

Large Rivets

(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$3.10
F.o.b. Chicago	3.20

Small Rivets

(⅞-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 10
F.o.b. Cleveland	70 and 10
F.o.b. Chicago	70 and 10

Cap and Set Screws

(Freight allowed up to but not exceeding 50c. per 100 lb. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screws	80, 10 and 5
Milled standard set screws, case hardened,	80 and 5
Milled headless set screws, cut thread	75 and 10
Upset hex. head cap screws, U.S.S. thread	85
Upset hex. cap screws, S.A.E. thread	85
Upset set screws	80, 10 and 5
Milled studs	70

tonnage worked, but competition throughout most of the year has been keyed to a high point and profits to shops have not been in keeping with the tonnage fabricated. The outlook is reasonably favorable. Much highway bridge work is contemplated for the coming year. Sizable building programs are under way at Chicago, which also will benefit by early construction on some of the World's Fair buildings and public improvements to be completed by 1933.

Mill prices on plain material, per lb.: 2.00c. base, Chicago.

Cast Iron Pipe.—Demand for this commodity is small as the year comes to a close. Sizable public utility inquiry is in the making, but it is doubtful if much of this will materialize before the middle of January. Bids at Milwaukee disclose the United States Pipe & Foundry Co. is low bidder, at $42.50 a ton, delivered, on 500 tons of 6-in. and 3500 tons of 8-in. pipe. James B. Clow & Sons are low, at $42.75 a ton, on 2500 tons of 12-in., and the Glamorgan Pipe & Foundry Co. is low on 1500 tons of 16-in. pipe. The freight rate Birmingham to Milwaukee is $8.50 a ton. Prices now governing on 6-in. and larger diameters are $34 a ton, Birmingham, or $42.20 a ton, delivered Chicago.

Prices per net ton, deliv'd Chicago: Water pipe, 6-in. and over, $42.20; 4-in., $46.20; Class A and gas pipe, $3 extra.

Sheets.—Output by hot mills during the holiday week was between 50 and 60 per cent of capacity. The Milwaukee mills are still down, and schedules are shaping so slowly that it now seems probable they will not be started at the turn of the year, as had been planned. At the same time, releases now in the hands of producers assure heavier rollings in the first week of January. Current specifications are light, and new buying is dull. Deliveries are at close range. Quotations on black sheets are holding at 2.80c. to 2.90c. a lb., delivered Chicago.

Base prices per lb., deliv'd from mill in Chicago: No. 24 black sheets, 2.80c. to 2.90c.; No. 24 galv., 3.55c. to 3.65c.; No. 10 blue ann'l'd, 2.35c. Deliv'd prices at other Western points are equal to the freight from Gary, plus the mill prices, which are 5c. per 100 lb. lower than Chicago delivered prices.

Old Material.—The weather continues to play an important part in the local scrap iron and steel market. Railroads are unusually slow in loading scrap and cars coming on track are in smaller number than at any time in the past year. Although many melters have fair stocks on the ground, they find these frozen and hard to work and are attempting to get new shipments on short notice. They are, however, meeting with little success. Price changes in the week have been confined to a few grades, but the undertone of strength noted a week ago is still present. Dealers continue to pay top prices for tonnages to cover old commitments, and the urge to take a long position in the market is spreading among sellers. The trade as a whole looks for more activity in January, with resultant higher quotations to consumers. However, with large buyers operating at reduced schedules, some sellers believe that the advance will not spread over wide limits. Buyers, except when pressed for immediate supplies, are following a cautious path. Some have placed orders with definite instructions for shipment soon after the turn of the year, but most current purchases are being left open as to dates of deliveries. Machine shop turnings have advanced 50c. a ton on recent sales and locomotive tires have recently been sold at $16, an advance of $1 a ton.

Prices deliv'd Chicago district consumers:

Per Gross Ton

Basic Open-Hearth Grades:	
Heavy melting steel	$12.50 to $13.00
Shoveling steel	12.50 to 13.00
Frogs, switches and guards, cut apart, and misc. rails	13.50 to 14.00
Hydraul. compressed sheets	11.00 to 11.50
Drop forge flashings	9.75 to 10.25
No. 1 busheling	11.00 to 11.50
Forg'd cast and r'l'd steel carwheels	17.50 to 18.00
Railroad tires, charg. box size	17.50 to 18.00
Railroad leaf springs cut apart	17.50 to 18.00
Acid Open-Hearth Grades:	
Steel couplers and knuckles	16.00 to 16.50
Coil springs	18.00 to 18.50
Electric Furnace Grades:	
Axle turnings	12.75 to 13.25
Low phos. punchings	15.00 to 15.50
Low phos. plates, 12 in. and under	15.00 to 15.50
Blast Furnace Grades:	
Axle turnings	10.50 to 11.00
Cast iron borings	9.25 to 9.75
Short shoveling turnings	9.25 to 9.75
Machine shop turnings	7.50 to 8.00
Rolling Mill Grades:	
Iron rails	14.50 to 15.00
Rerolling rails	14.50 to 15.00
Cupola Grades:	
Steel rails less than 3 ft.	16.50 to 17.50
Steel rails less than 2 ft.	18.50 to 19.00
Angle bars, steel	15.25 to 15.75
Cast iron carwheels	13.75 to 14.25
Malleable Grades:	
Railroad	16.25 to 16.75
Agricultural	14.50 to 15.00
Miscellaneous:	
*Relaying rails, 56 to 60 lb.	23.00 to 25.00
*Relaying rails, 65 lb. and heav.	26.00 to 31.00

Per Net Ton

Rolling Mill Grades:	
Iron angle and splice bars	15.00 to 15.50
Iron arch bars and transoms	17.00 to 17.50
Iron car axles	25.50 to 26.00
Steel car axles	15.75 to 16.25
No. 1 railroad wrought	12.00 to 12.50
No. 2 railroad wrought	11.00 to 11.50
No. 1 busheling	9.00 to 9.50
No. 2 busheling	7.00 to 7.50
Locomotive tires, smooth	15.50 to 16.00
Pipes and flues	9.50 to 10.00
Cupola Grades:	
No. 1 machinery cast	13.50 to 14.00
No. 1 railroad cast	12.50 to 13.00
No. 1 agricultural cast	12.00 to 12.50
Stove plate	10.50 to 11.00
Grate bars	10.75 to 11.25
Brake shoes	10.50 to 11.00

*Relaying rails, including angle bars to match, are quoted f.o.b. dealers' yards.

Wire Products.—Increased activity by public utility companies is reflected in sizable inquiries for copper wire and cables. This situation gives promise that shrinkage in order books will soon be checked. Buyers' needs in plain wire and nails are small at this time of the year and this is reflected in releases to mills. Output has been sharply curtailed. Many units have closed down for the week, giving an opportunity for repairs and improvements. The price situation in central Illinois and Indiana is clearing. For several weeks concessions were made here and there of as much as $2 a ton. Bright hard wire to the manufacturing trade is again well stabilized at 2.45c. a lb. in carload lots, Chicago.

Rails and Track Supplies.—The Burlington has ordered 57,100 tons of standard-section rails for its own use, and still has to buy tonnages for the Fort Worth & Denver City and the Colorado & Southern. Of the tonnage ordered, Illinois Steel Co. was given 26,100 tons, Inland Steel Co., 13,600 tons, and the Colorado mill, 17,400 tons. Track accessory purchases total 4000 tons, with miscellaneous inquiries aggregating 12,000 tons. Schedules now being arranged call for early increases in output of rails and accessories. Shipments of light rails this year show slight improvement over the tonnage delivered in 1928.

Prices f.o.b. mill, per gross ton: Standard section open-hearth and Bess. rails, $43; light rails, rolled from billets, $36. *Per lb.:* Standard railroad spikes, 2.80c.; track bolts with square nuts, 3.80c.; steel tie plates, 2.07½c. to 2.15c.; angle bars, 2.75c.

Bolts, Nuts and Rivets.—Releases by car builders, the railroads and manufacturers of farm equipment are steady. Car shops have sizable orders ahead, and business in prospect is satisfactory. Farm machinery builders look to the future with confidence and expect to hold present production schedules through the winter months.

Coke.—Forward contracting is more active, and the bulk of first half commitments have been made. Prices for by-product foundry coke remain firm at $8 a ton, f.o.b. local ovens.

Buffalo

Holiday Week Dullness Pervades All Markets

BUFFALO, Dec. 30.—The pig iron market is in the midst of its usual holiday lull. So far as can be learned, the General Electric Co. inquiry for 4000 tons, mentioned last week, is still pending. Pig iron stocks in producers' yards are low.

Prices per gross ton, f.o.b. furnace:

No. 2 fdy., sil. 1.75 to 2.25	$19.50
No. 2X fdy., sil. 2.25 to 2.75	20.00
No. 1 fdy., sil. 2.75 to 3.25	21.00
Malleable, sil. up to 2.25	20.00
Basic	$17.00 to 18.00
Lake Superior charcoal	27.28

Finished Steel.—Operations of the Lackawanna plant of the Bethlehem Steel Co. are continuing as in the pre-

Warehouse Prices, f.o.b. Buffalo

	Base, per Lb.
Plates and struc. shapes	3.40c.
Soft steel bars	3.30c.
Reinforcing bars	2.95c.
Cold-fin. flats, sq. and hex	4.45c.
Rounds	3.95c.
Cold-rolled strip steel	5.85c.
Black sheets (No. 24)	4.20c.
Galv. sheets (No. 24)	4.85c.
Blue ann'l'd sheets (No. 10)	3.50c.
Com. wire nails, base per keg	$3.60
Black wire, base per 100 lb	3.75

ceding week, with 18 of 24 open-hearths active. The plant of the Donner Steel Co. was shut down for the holiday week. School No. 67, Buffalo, will require 187 tons of reinforcing bars, contract for which has been let, and the remainder of the bars for the new City Hall, amounting to 350 tons, was also awarded.

Old Material.—The market is very quiet. Operations in dealers' yards were brought to a complete standstill for a part of last week by one of the most severe sleet storms ever experienced in western New York. Dealers do not look for any important activity until about the middle of January.

Prices per gross ton, f.o.b. Buffalo consumers' plants:

Basic Open-Hearth Grades:		
No. 1 heavy melting steel.		$14.00
No. 2 heavy melting scrap.		12.50
Scrap rails	$13.00 to	14.00
Hydraul. comp. sheets		12.50
Hand bundled sheets	10.50 to	11.00
Drop forge flashings	12.50 to	13.00
No. 1 busheling		12.50
Hvy. steel axle turnings	12.50 to	13.00
Machine shop turnings	8.00 to	8.50
No. 1 railroad wrought	10.50 to	11.00
Acid Open-Hearth Grades:		
Knuckles and couplers	17.00 to	17.50
Coil and leaf springs	17.00 to	17.50
Rolled steel wheels	17.00 to	17.50
Low phos. billet and bloom ends	18.00 to	18.50
Electric Furnace Grades:		
Short shov. steel turnings	10.75 to	11.25
Blast Furnace Grades:		
Short mixed borings and turnings	10.75 to	11.25
Cast iron borings	10.75 to	11.25
No. 2 busheling		8.00
Rolling Mill Grades:		
Steel car axles	16.50 to	17.00
Iron axles	20.00 to	21.00
Cupola Grades:		
No 1 machinery cast	14.50 to	15.00
Stove plate		12.15
Locomotive grate bars	10.00 to	10.50
Steel rails, 3 ft. and under	17.75 to	18.00
Cast iron carwheels	11.50 to	12.00
Malleable Grades:		
Industrial	16.50 to	17.00
Railroad	16.50 to	17.00
Agricultural	16.50 to	17.00
Special Grades:		
Chemical borings	12.00 to	12.50

Tractor Plant to Expand Operations

R. C. Force, president of the Caterpillar Tractor Co., San Leandro, Cal., in a telegram to the Peoria, Ill., Manufacturers and Merchants' Association, announced that within the next 90 days 2000 more men will be employed in the East Peoria plant where enlarged tractor and combined factories and foundry will be in operation. Before next June another 1000 will be added, bringing the total force to between 6000 and 7000 men, Mr. Force stated.

A Buffalo chapter of the Gray Iron Institute has been organized, eight foundries in that district that are members of the institute forming the nucleus of the chapter which has named temporary officers and will complete its organization soon. This is the first of a series of local chapters that will be organized by members of the institute in important foundry centers.

New York

Subway Work Takes 18,700 Tons of Structural Steel—Pig Iron Sales Total 7000 Tons

NEW YORK, Dec. 30.—Pig iron sales in the past week totaled 7000 tons. The Eastern Malleable Iron Co. closed against its inquiry for 1500 tons for its Bridgeport, Conn., and Wilmington, Del., plants. The Worthington Pump & Machinery Corporation bought 1600 tons, of which 750 tons was for Harrison, N. J., and the remainder for Holyoke, Mass., and Elmwood Place, Ohio. The General Electric Co.'s inquiry for 4000 tons or more is still pending. The market reflects the year-end lull, very little fresh tonnage having come up for figures. It is estimated that fully 50 per cent of the pig iron requirements of this territory for the coming quarter are still to be placed. Moreover, the inventories of most foundries are very low, indicating that there will soon be pressure for shipments on orders outstanding, as well as the placing of considerable spot business. The price situation is unchanged.

Prices per gross ton, delivered New York district:

Buffalo No. 2 fdy., sil. 1.75 to 2.25	$21.91 to $22.41
*Buff. No. 2, del'd east. N. J.	20.28 to 20.78
East. Pa. No. 2 fdy., sil. 1.75 to 2.25	19.89 to 21.02
East. Pa. No. 2X fdy., sil. 2.25 to 2.75	20.39 to 21.52

Freight rates: $4.91 from Buffalo, $1.39 to $2.52 from eastern Pennsylvania.

*Prices delivered to New Jersey cities having rate of $3.28 a ton from Buffalo.

Reinforcing Bars.—An order of 1200 tons to the Truscon Steel Co. for the Ford assembly plant at Edgewater, N. J., and another of 1200 tons to the Concrete Steel Co. for route 108, sections three and four, of the Queens Subway, were the outstanding transactions of the week. Otherwise, the market remains quiet. Prices are unchanged.

Cast Iron Pipe.—A fair-sized tonnage of pipe is being inquired for by private gas and water companies for spring delivery, and some awards are expected in the next week or 10 days. On 750 tons of water pipe and fittings for Manchester, N. H., a low bid was submitted by R. D. Wood & Co., Florence, N. J., who quoted $36.45 a ton, delivered, with a freight rate of $5.10 a ton. The Portland Water District, Portland, Me., has placed 900 tons of centrifugal pipe with R. D. Wood & Co. Prices show no tendency toward greater strength.

Prices per net ton deliv'd New York: Water pipe, 6-in. and larger, $34.60 to $36.60; 4-in. and 5-in., $37.60 to $39.60; 3-in., $44.60 to $46.60. Class A and gas pipe $3 extra.

Finished Steel.—With awards totaling almost 28,000 tons and with fresh inquiries of 19,000 tons in the New York district, structural steel continues the feature of the market. The American Bridge Co. will supply 18,700 tons of steel for a subway section in Brooklyn. Chief among pending jobs is 12,600 tons for electrification on the Pennsylvania Railroad at its West Philadelphia yards and on its main line from Trenton to New

Warehouse Prices, f.o.b. New York

	Base per Lb.
Plates and structural shapes	3.30c.
Soft steel bars, small shapes	3.25c.
Iron bars	3.24c.
Iron bars, Swed. charcoal	7.00c. to 7.25c.
Cold-fin. shafting and screw stock—	
Rounds and hexagons	3.50c.
Flats and squares	4.00c.
Cold-roll. strip, soft and quarter hard	5.15c. to 5.40c.
Hoops	4.25c.
Bands	3.75c.
Blue ann'l'd sheets (No. 10)	3.25c. to 3.90c.
Long terne sheets (No. 24)	5.80c.
Standard tool steel	12.00c.
Wire, black annealed	4.50c.
Wire, galv. annealed	5.15c.
Tire steel, ½ x ½ in. and larger	3.40c.
Smooth finish, 1 to 2½ x ¼ in. and larger	3.75c.
Open-hearth spring steel, bases,	4.50c. to 7.00c.

	Per Cent Off List
Machine bolts, cut threads:	
¾ x 6 in. and smaller	60
1 x 30 in. and smaller	50 to 50 and 10
Carriage bolts, cut thread:	
½ x 6 in. and smaller	60
¾ x 20 in. and smaller	50 to 50 and 10
Coach Screws:	
½ x 6 in. and smaller	60
1 x 6 in. and smaller	50 to 50 and 10

	Per 100 Ft.
Boiler Tubes—	
Lap welded, 2-in.	$17.33
Seamless steel, 2-in.	20.24
Charcoal iron, 2-in.	25.00
Charcoal iron, 4-in.	67.00

Discounts on Welded Pipe

Standard Steel—	Black	Galv.
⅛-in. butt	46	29
¼-in. butt	51	37
1-3-in. butt	53	39
2½-6-in. lap	48	35
7 and 8-in. lap	44	17
11 and 12-in. lap	37	12
Wrought Iron—		
⅛-in. butt	5	+19
¼-in. butt	11	+ 9
1-1½-in. butt	14	+ 6
2-in. lap	5	+14
3-6-in. lap	11	+ 6
7-12-in. lap	3	+16

Tin Plate (14 x 20 in.)

	Prime	Seconds
Coke, 100 lb. base box	$6.45	$6.20
Charcoal, per Box—	A	AAA
IC	$9.70	$12.10
IX	12.00	14.25
IXX	13.90	16.00

Terne Plate (14 x 20 in.)

IC—20-lb. coating	$10.00 to $11.00
IC—30-lb. coating	12.00 to 13.00
IC—40-lb. coating	13.75 to 14.25

Sheets, Box Annealed—Black, C. R. One Pass

	Per Lb.
Nos. 18 to 20	3.70c.
No. 22	3.85c.
No. 24	3.90c.
No. 26	4.00c.
No. 28*	4.15c.
No. 30	4.40c.

Sheets, Galvanized

	Per Lb.
No. 14	4.15c.
No. 16	4.00c.
No. 18	4.15c.
No. 20	4.25c.
No. 22	4.35c.
No. 24†	4.50c.
No. 26	4.75c.
No. 28*	5.00c.
No. 30	5.40c.

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

†For 50 bundles or more, 25c. per 100 lb. less.

York. It is estimated that in the first four months of 1930 approximately 40,000 tons of steel will be required for further subway construction work. Aside from the activity in structural steel, business has been fair. One important district steel office reports that December bookings have been better than those of November and also are ahead of those in December, 1928. However, this is the exception rather than the rule. The wire market is weak, with common wire nails selling at $2.35 a keg and large jobbers in some cases getting even lower prices. Demand for bars and plates has been light, but quotations are unchanged. Export business to Canada, Mexico and Japan has been moderately good, but sales to other countries have been poor.

Mill prices per lb., deliv'd New York: Soft steel bars, 2.24c.; plates, 2.17½c. to 2.22½c.; structural shapes, 2.09½c. to 2.14½c.; bar iron, 2.14c.

Coke.—Shipments are light, reflecting year-end shutdowns. Standard furnace coke has declined 5c. a ton, now ranging from $2.60 to $2.70, Connellsville. By-product foundry coke remains at $9 to $9.40, Newark or Jersey City, and $10.06, New York or Brooklyn. Special grades of beehive foundry coke are bringing $4.85, Connellsville, or $8.56, delivered Jersey City or Newark, and $9.44, New York or Brooklyn.

Old Material.—Consumers of scrap are generally unwilling to contract except at reductions from the most recent market prices, and brokers are not inclined to risk losses by selling at a level too low to permit them to cover their commitments. Meanwhile, steel mills have been more active than usual in bidding for various grades of scrap direct to the railroad or industrial producer. Consumers are offering to buy No. 1 heavy melting steel at $14 a ton, delivered eastern Pennsylvania, for contracts, but brokers are asking $14.50. No. 2 heavy melting steel is being bought at $9.20 a ton, New York, for shipment to Weirton, W. Va., which is about $1 a ton more than is paid for steel to ship to eastern Pennsylvania. Only a moderate tonnage is moving at the higher price, however, as inspection is severe and some dealers prefer to continue shipping to eastern Pennsylvania mills.

Dealers' buying prices per gross ton, f.o.b. New York:

No. 1 heavy melting steel	$10.50 to	$11.25
Heavy melting steel (yard)	7.50 to	8.00
No. 1 hvy. breakable cast	10.00 to	10.50
Stove plate (steel works)		8.00
Locomotive grate bars		8.25
Machine shop turnings	7.00 to	7.50
Short shoveling turnings	7.25 to	7.50
Cast borings (blast fur. or steel works)	7.00 to	7.50
Mixed borings and turnings	6.75 to	7.50
Steel car axles	15.25 to	16.25
Iron car axles	20.50 to	21.00
Iron and steel pipe (1 in. dia., not under 2 ft. long)	9.25 to	9.75
Forge fire	8.50 to	9.00
No. 1 railroad wrought	11.50 to	12.50
No. 1 yard wrought, long	10.50 to	11.50
Rails for rolling	10.50 to	11.00
Stove plate (foundry)	8.25 to	8.50
Malleable cast (railroad)	12.50 to	13.00
Cast borings (chemical)	8.50 to	9.50

Prices per gross ton, deliv'd local foundries:

No. 1 machry. cast	$15.00
No. 1 hvy. cast (columns, bldg. materials, etc.), cupola size	13.00
No. 2 cast (radiators, cast boilers, etc.)	12.50

greater activity the past week, during which Cleveland interests sold 15,000 tons of foundry and malleable iron. Inquiry also improved, and indications point to a moderate buying movement in January. Some of the inquiries are for lots of 1000 to 2000 tons. A large share of foundries have not yet contracted for the first quarter, many carrying over enough iron from fourth quarter contracts to last them well into the new quarter. Shipping orders increased during the week, these for the most part being for delivery starting after Jan. 1. These releases are largely from the automobile foundries and indicate that that industry will take more iron in January than in November and December. Steel foundries have taken about twice as much low phosphorus iron this month as in November. However, buying of this grade for the first quarter has not started. The market is firm at the prices that have prevailed recently, or $18.50, Cleveland, for foundry and malleable iron for outside shipment, $19, furnace, for local delivery and $19.50 to $20, furnace, for Michigan shipment. Foundry operations in Ohio decreased this month. Operations during November, according to the monthly report of the Ohio Foundries Association, Inc., were at 90 per cent of normal capacity, as compared with 115 per cent in October and with 91 per cent in November, last year.

Prices per gross ton at Cleveland:

N'th'n fdy., sil. 1.75 to 2.25		$19.50
S'th'n fdy., sil. 1.75 to 2.25	$20.01 to	20.51
Malleable		19.50
Ohio silvery, 8 per cent		28.00
Basic Valley furnace		18.50
Stand. low phos., Valley	26.50 to	27.00

Prices except on basic and low phosphorus are delivered Cleveland. Freight rates: 50c. from local furnaces; $3 from Jackson, Ohio; $6.01 from Birmingham.

Cleveland

Steel Demand on Uptrend but Improvement is Slight—Automobile Companies Ordering Cautiously

CLEVELAND, Dec. 30.—The new year will start with the demand for steel on the uptrend and an outlook for a further improvement during January. Orders for finished steel in most forms showed a slight gain during the week. The volume of steel business in the heavier rolled forms during December was slightly less than in November. Stocks have been reduced to a minimum for inventories and the immediate needs of consumers are responsible for the increase in orders. However, buying is in small lots and for early requirements. The automotive industry is placing orders only for early needs and quick deliveries usually are asked for.

While most motor car manufacturers will increase their production in January over the past two months, the size of their steel orders does not indicate that they plan more than a moderate increase in production schedules. Dealers in some makes of motor cars still have good stocks of old cars that are moving slowly, and until these stocks are greatly reduced the manufacture of new models probably will be kept low. Prices appear well stabilized, although there is some pressure from the automotive industry for concessions.

Some of the sheet and strip mills are operating better this week than early in the month. They accumulated a little backlog during their holiday shutdown last week. Independent steel companies in Cleveland are now operating 11 open-hearth furnaces, as compared with three early in the month.

Pig Iron.—The market showed

Warehouse Prices, f.o.b. Cleveland

	Base per Lb.
Plates and struc. shapes	3.00c.
Soft steel bars	3.00c.
Reinforc. steel bars	2.25c. to 2.50c.
Cold-fin. rounds and hex.	3.65c.
Cold-fin. flats and sq.	4.15c.
Hoops and bands, No. 12 to ¼ in., inclusive	3.25c.
Hoops and bands, No. 13 and lighter	3.65c.
Cold-finished strip	*5.95c.
Black sheets (No. 24)	3.70c. to 3.90c.
Galvanized sheets (No. 24)	4.60c. to 4.75c.
Blue ann'l'd sheets (No. 10)	3.25c.
No. 9 ann'l'd wire, per 100 lb.	$2.65
No. 9 galv. wire, per 100 lb.	3.00
Com. wire nails, base per keg	2.65

*Net base, including boxing and cutting to length.

Semi-Finished Steel.—Several consumers closed contracts during the week with a local mill for sheet bars at $34, Cleveland. No contracting has as yet been done in billets and slabs, which are quoted at the same price. Considerable tonnage on last quarter contracts was not taken out. These contracts, which recently were revised to $34, are being canceled. Specifications fell off the past week owing to the holiday shutdown of many mills.

Sheets.—Orders show a slight increase from the automotive industry, and fair specifications are coming from the steel barrel manufacturers. Demand from other sources is very light. The automotive industry is ordering only in small lots for early requirements, and quick shipments are usually insisted upon. Black sheets are firm at 2.75c., Pittsburgh. Blue annealed sheets are being shaded by continuous mills.

Strip Steel.—Demand for cold-rolled strip gained somewhat during the week. Some of the mills also report a better volume of orders for hot-rolled strip, but with others specifications continue very light. Reports that large buyers in Detroit have been able to secure concessions from 1.90c. for wide strip and 2c. for nar-

row have caused some hesitation among buyers in this territory. However, regular prices appear to be well maintained here. Cold-rolled strip is quoted at 2.75c., Cleveland.

Wire Products.—A number of consumers have released specifications for manufacturers' wire against first quarter contracts. The price is firm at 2.40c., Cleveland. Nails are extremely dull.

Bars, Plates and Shapes.—Orders for small lots of steel bars increased the past week, and some of the mills have a fair tonnage on order for shipment after Jan. 1. Plates are in fair demand. Some good orders are coming out for locomotive work. The Texas Co. is inquiring for small tanks for service stations requiring 2000 to 3000 tons of plates. Structural shapes are quiet. Inquiry in the building field is very light, but considerable highway bridge work is pending. Prices are steady at 1.90c., Pittsburgh, for plates and shapes and at 1.85c. to 1.90c., Cleveland, for steel bars. Mills have closed contracts with most of their consumers for the first quarter.

Coke.—One producer has reestablished its present price of $4.85, ovens, for Connellsville foundry coke for the first quarter and some contracts have been renewed at that price. There has also been some renewal of contracts for by-product foundry coke. Ohio by-product foundry coke is quoted at $8.25, ovens, for January shipment.

Old Material.—Dealers are buying some steel-making scrap for shipment to the Youngstown district, but otherwise the market is at a standstill. While heavy melting steel was bought during the week as low as $15 for delivery to Youngstown mills, $15.50 is the more common price. Dealers are paying $14.50 for compressed sheet steel for Youngstown shipment. Cleveland mills are taking very little scrap, but more liberal releases are expected the first of the month.

Prices per gross ton delivered consumers' yards:

Basic Open-Hearth Grades:	
No. 1 heavy melting steel	$13.50 to $14.00
No. 2 heavy melting steel	13.00 to 13.50
Compressed sheet steel	12.50 to 13.00
Light bundled sheet stampings	11.50 to 12.00
Drop forge flashings	11.50 to 12.00
Machine shop turnings	9.00 to 9.50
Short shoveling turnings	11.00 to 11.50
No. 1 railroad wrought	13.00 to 13.50
No. 2 railroad wrought	14.00 to 14.50
No. 1 busheling	12.00 to 12.50
Pipes and flues	9.00 to 9.50
Steel axle turnings	12.50 to 13.00
Acid Open-Hearth Grades:	
Low phos., forging crops	17.75 to 18.00
Low phos., billet, bloom and slab crops	18.50 to 18.75
Low phos., sheet bar crops	18.00 to 18.50
Low phos., plate scrap	18.00 to 18.50
Blast Furnace Grades:	
Cast iron borings	9.75 to 10.00
Mixed borings and short turnings	9.75 to 10.00
No. 2 busheling	9.75 to 10.00
Cupola Grades:	
No. 1 cast	15.25 to 15.75
Railroad grate bars	11.00 to 12.00
Stove plate	12.00 to 12.50
Rails under 3 ft	18.50 to 19.50
Miscellaneous:	
Railroad malleable	18.00 to 18.50
Rails for rolling	16.25 to 16.50

Philadelphia

Steel Mills and Consumers Resuming Operations After Holidays—Pig Iron Inquiry Better

PHILADELPHIA, Dec. 30.—Most of the Eastern steel mills have resumed operation after a suspension of a few days to a full week over the holiday period. Contracting for first quarter has been limited, but a fair tonnage of specifications for early shipment has been postponed until after the first of the year. Consumers of steel in this district are resuming operations, with the exception of automobile body builders, which have had some temporary postponements on contracts with the car manufacturers.

Pig Iron.—Inquiry for foundry iron has shown a definite improvement in the past week or 10 days, some of the larger consumers having asked for prices on substantial tonnages, preliminary to issuing formal inquiries. The Standard Steel Works Co., Burnham, Pa., is in the market for 3000 to 4000 tons of low phosphorus iron. On current foundry iron business, prices still range from $20 to $21 a ton, furnace, the lower quotation being made in competition with Southern pig iron. Basic iron continues quiet.

Prices per gross ton at Philadelphia:

East. Pa. No. 2, 1.75 to 2.25 sil.	$20.76 to $21.76
East. Pa. No. 2, 2.25 to 2.75 sil.	21.26 to 22.26
East. Pa. No. 1X	21.72 to 22.76
Basic (del'd east. Pa.)	19.50 to 19.75
Gray forge	20.00 to 20.50
Malleable	21.25 to 21.75
Stand. low phos. (f.o.b. N. Y. State furnace)	22.00 to 23.00
Cop. br'g low phos. (f.o.b. furnace)	23.00 to 24.00
Va. No. 2 plain, 1.75 to 2.25 sil.	22.29
Va. No. 2X, 2.25 to 2.75 sil.	22.79

Prices, except as specified otherwise, are deliv'd Philadelphia. Freight rates: 76c. to $1.64 from eastern Pennsylvania furnaces; $4.54 from Virginia furnaces.

Old Material.—Buying has been limited to small lots, and prices still show a decided lack of strength. No. 1 railroad wrought is quotable at $15 to $15.50 a ton, delivered, a decline of 50c. a ton, and cast iron carwheels are also off 50c. a ton, with the market at $15 to $15.50, delivered. Hydraulic compressed sheets, new, are quoted at $13 a ton, delivered, with eastern Pennsylvania consumers generally deducting $1.50 a ton from the No. 1 heavy melting steel price for this grade of scrap.

Prices per gross ton delivered consumers' yards, Philadelphia district:

No. 1 heavy melting steel	$14.50
Scrap T rails	14.00
No. 2 heavy melting steel	$12.00 to 12.50
No. 1 railroad wrought	15.00 to 15.50
Bundled sheets (for steel works)	11.50
Hydraulic compressed, new	13.00
Hydraulic compressed, old	12.00 to 12.50
Machine shop turnings (for steel works)	11.00
Heavy axle turnings (or equiv.)	12.50 to 13.00
Cast borings (for steel works and roll. mill)	11.00
Heavy breakable cast (for steel works)	13.50 to 14.00
Railroad grate bars	11.00 to 11.50
Stove plate (for steel works)	11.00 to 11.50
No. 1 low phos., hvy., 0.04% and under	20.50 to 21.50
Couplers and knuckles	19.00 to 19.50
Rolled steel wheels	19.00 to 19.50
No. 1 blast f'nace scrap	10.50 to 11.00
Wrot. iron and soft steel pipes and tubes (new specific.)	14.00
Shafting	19.00
Steel axles	20.00 to 21.00
No. 1 forge fire	13.00 to 13.50
Cast iron carwheels	15.00 to 15.50
No. 1 cast	15.00 to 15.50
Cast borings (for chem. plant)	14.00 to 14.50
Steel rails for rolling	15.00 to 15.50

Finished Steel.—Shape prices are unchanged at 1.85c. to 1.90c. a lb., f.o.b. nearest mill to consumer, or 1.91c. to 1.96c. a lb., delivered Philadelphia. Fabricators are bidding on a good volume of new work, including about 12,000 tons of truss, signal and catenary bridge construction for the Pennsylvania Railroad electrification. Some steel plate contracts have been closed for first quarter, but most consumers are covering requirements as they arise, with the market at 2c. a lb., Coatesville, or 2.10c., delivered Philadelphia. Steel bars are quiet, but the price is firm at 1.90c., Pittsburgh, or 2.22c., delivered Philadelphia. A substantial volume of inquiry for reinforcing bars is in the market, most of which is expected to be placed within the next fortnight. Sheet quotations are much firmer on contracts than for early delivery. Blue annealed sheets, No. 13 gage, are quoted at 2.35c. a lb., Pittsburgh, or 2.67c., delivered Philadelphia, with the usual concessions of $2 to $4 a ton granted to preferred buyers. Blue annealed plates range from 2.10c. to 2.20c., Pittsburgh, or 2.42c. to 2.52c., delivered Philadelphia. Black sheets are generally quoted at 2.75c., Pittsburgh, or 3.07c., Philadelphia, to consumers wishing to make contracts, but on orders for current delivery the price ranges from 2.65c. to 2.70c. a lb., Pittsburgh, or 2.97c. to 3.02c., Philadelphia. Galvanized sheets are quiet at

Warehouse Prices, f.o.b. Philadelphia

	Base per Lb.
Plates, ¼-in. and heavier	2.70c.
Plates, ⅜-in.	2.90c.
Structural shapes	2.70c.
Soft steel bars, small shapes, iron bars (except bands)	2.80c.
Round-edge iron	3.50c.
Round-edge steel, iron finished 1½ x 1½ in.	3.50c.
Round-edge steel planished	4.30c.
Reinforc. steel bars, sq., twisted and deform	2.60c. to 2.80c.
Cold-fin. steel, rounds and hex.	3.50c.
Cold-fin. steel, sq. and flats	4.00c.
Steel hoops	3.55c.
Steel bands, No. 12 to ⅛-in. inclus.	3.30c.
Spring steel	5.00c.
*Black sheets (No. 24)	3.90c.
†Galvanized sheets (No. 24)	4.65c.
Light plates, blue annealed (No. 10)	3.25c.
Blue ann'l'd sheets (No. 13)	3.40c.
Diam. pat. floor plates—	
¼-in.	5.30c.
⅜-in.	5.50c.
Rails	3.20c.
Swedish iron bars	6.60c.

*For 50 bundles or more; 10 to 49 bun., 4.10c. base; 1 to 9 bun., 4.35c. base.
†For 50 bundles or more; 10 to 49 bun., 4.95c. base; 1 to 9 bun., 5.30c. base.

3.40c., Pittsburgh, or 3.72c., Philadelphia.

Imports.—In the week ended Dec. 28, 864 tons of pig iron arrived at this port, of which 496 tons came from British India, 308 tons from Norway, and 60 tons from Sweden. Ore arrivals consisted of 14,800 tons of iron ore from Algeria, and 8130 tons of chrome ore, of which 4630 tons was from Cuba and 3500 tons from Portuguese Africa. Steel arrivals were four tons of steel scrap from Germany, and the following from Sweden: 100 tons of steel bars, nine tons of steel billets, three tons of drill steel, eight tons of chrome bearing tubing and two tons of bar iron.

St. Louis

Pig Iron and Scrap Firm But Dull

ST. LOUIS, Dec. 30.—First quarter buying of pig iron has not developed to any considerable extent, but it is understood that inquiries are pending for several thousand tons of both malleable and foundry grades which makers expect to close shortly after the turn of the year. Buying for immediate shipment has been extremely light. Foundry operations in metropolitan St. Louis during the 11 months ended Nov. 30 were at about a 10 per cent higher rate as a whole than during the same period of 1928, but unfilled orders were reported, in most cases, as considerably less than at the same time in 1928, according to the business review of the Chamber of Commerce.

Prices per gross ton at St. Louis:

No. 2 fdy., sil. 1.75 to 2.25, f.o.b. Granite City, Ill.	$19.50 to $20.00
Malleable, f.o.b. Granite City	20.00
N'th'n No. 2 fdy., deliv'd St. Louis	22.16
Southern No. 2 fdy., deliv'd	18.92 to 19.42
Northern malleable, deliv'd	22.16
Northern basic, deliv'd	22.16

Freight rates: 75c. (average) Granite City to St. Louis; $2.16 from Chicago; $4.42 from Birmingham.

Old Material.—The scrap market continues dull. Consumers in the district still hold up shipments. No new business is being placed, and mills have failed to signify how soon after the first of the year they will be in the market for material. Prices are unchanged. Railroad lists: Cleveland, Cincinnati, Chicago & St. Louis, 1300 tons; Missouri-Kansas-Texas, 1200 tons, and Missouri Pacific, 151 carloads.

Dealers' buying prices per gross ton, f.o.b. St. Louis district:

No. 1 heavy melting or shoveling steel	$13.00 to $13.50
No. 2 heavy melting or shoveling steel	12.00 to 12.50
No. 1 locomotive tires	14.50 to 15.00
Misc. stand.-sec. rails including frogs, switches and guards, cut apart	14.00 to 14.50
Railroad springs	15.50 to 16.00
Bundled sheets	9.50 to 10.00
No. 2 railroad wrought	13.00 to 13.50
No. 1 busheling	9.75 to 10.25
Cast iron borings and shoveling turnings	9.25 to 9.75
Iron rails	13.00 to 13.50
Rails for rolling	15.00 to 15.50
Machine shop turnings	6.75 to 7.25
Heavy turnings	9.50 to 10.00
Steel car axles	18.00 to 18.50
Iron car axles	25.50 to 26.00
Wrot. iron bars and trans.	21.50 to 22.00
No. 1 railroad wrought	13.00 to 13.50
Steel rails, less than 3 ft.	17.00 to 17.50
Steel angle bars	14.00 to 14.50
Cast iron carwheels	14.00 to 14.50
No. 1 machinery cast	15.25 to 15.75
Railroad malleable	13.50 to 14.00
No. 1 railroad cast	14.50 to 15.00
Stove plate	11.75 to 12.25
Relay. rails 60 lb. and under	20.50 to 23.50
Relay. rails 70 lb. and over	26.50 to 29.00
Agricult. malleable	14.00 to 14.50

Warehouse Prices, f.o.b. St. Louis

	Base per Lb.
Plates and struc. shapes	3.25c.
Bars, soft steel or iron	3.15c.
Cold-fin. rounds, shafting, screw stock	3.75c.
Black sheets (No. 24)	4.25c.
Galv. sheets (No. 24)	5.10c.
Blue ann'l'd sheets (No. 10)	3.45c.
Black corrug. sheets (No. 24)	4.30c.
Galv. corrug. sheets	5.15c.
Structural rivets	4.15c.
Boiler rivets	4.15c.
	Per Cent Off List
Tank rivets, ⅞-in. and smaller, 100 lb. or more	65
Less than 100 lb	60
Machine bolts	60
Carriage bolts	60
Lag screws	60
Hot-pressed nuts, sq., blank or tapped, 200 lb. or more	60
Less than 200 lb	50
Hot-pressed nuts, hex., blank or tapped, 200 lb. or more	60
Less than 200 lb	50

Boston

Year-End Pig Iron Sales Are Small

BOSTON, Dec. 30.—The closing days of 1929 failed to develop much pig iron business. The Worthington Pump & Machinery Corporation, Holyoke, Mass., through its New York office purchased several hundred tons, but details are lacking. Other sales were mostly small. Several large consumers are feeling out the market, but have made no definite inquiry. The General Electric Co. will close soon on 1000 tons for Pittsfield and Lynn, Mass.; a Connecticut melter will buy 1000 tons or more of gray and malleable iron; and there are two or three smaller lots to be purchased soon. Although Alabama iron has been advanced 50c. a ton to $15, base furnace, that price does not apply in New England. So far as can be ascertained, Buffalo furnaces have not sold No. 2 plain and No. 2X iron for less than $17 a ton, furnace.

Buying prices per gross ton, f.o.b. Boston rate shipping points:

No. 1 heavy melting steel	$9.50 to $10.00
Scrap T rails	9.50 to 10.00
Scrap girder rails	8.50 to 9.00
No. 1 railroad wrought	10.50 to 10.75
No. 1 yard wrought	9.50 to 10.00
Machine shop turnings	6.00 to 6.50
Cast iron borings (steel works and rolling mill)	6.00 to 6.50
Bundled skeleton, long	8.25 to 8.50
Forge flashings	8.00 to 8.50
Blast furnace borings and turnings	5.75 to 6.25
Forge scrap	8.50 to 9.00
Shafting	13.50 to 14.00
Steel car axles	15.50 to 16.00
Wrought pipe 1 in. in diameter (over 2 ft. long)	9.00 to 9.50
Rails for rolling	10.50 to 11.00
Cast iron borings, chemical	9.00 to 9.50
Prices per gross ton deliv'd consumers' yards:	
Textile cast	$14.00 to $14.50
No. 1 machinery cast	15.00 to 15.25
No. 2 machinery cast	13.00 to 13.25
Stove plate	9.00 to 10.00
Railroad malleable	17.00 to 18.00

Warehouse Prices, f.o.b. Boston

	Base per Lb.
Plates	3.365c.
Structural shapes—	
Angles and beams	3.365c.
Tees	3.365c.
Zees	3.465c.
Soft steel bars, small shapes	3.265c.
Flats, hot-rolled	4.15c.
Reinforcing bars	3.265c. to 3.54c.
Iron bars—	
Refined	3.265c.
Best refined	4.60c.
Norway rounds	6.60c.
Norway squares and flats	7.10c.
Spring steel—	
Open-hearth	5.00c. to 10.00c.
Crucible	12.00c.
Tie steel	4.50c. to 4.75c.
Bands	4.015c. to 5.00c.
Hoop steel	5.50c. to 6.00c.
Cold-rolled steel—	
Rounds and hex.	*3.55c. to 5.55c.
Squares and flats	*4.05c. to 7.05c.
Toe calk steel	6.00c.
Rivets, structural or boiler	4.50c.
	Per Cent Off List
Machine bolts	50 and 5
Carriage bolts	50 and 5
Lag screws	50 and 5
Hot-pressed nuts	50 and 5
Cold-punched nuts	50 and 5
Stove bolts	70 and 10

*Including quantity differentials.

Old Material.—A Worcester, Mass., mill took limited tonnages of long bundled skeleton at $10.75 a ton, delivered, which figures back to about $8.35, on cars shipping point, and car lots of No. 1 heavy melting steel were shipped to the Pittsburgh territory, but business in scrap otherwise was small the past week. Weather conditions have been a contributing factor to the slack scrap business, snow and ice making it difficult to handle material.

Foundry iron prices per gross ton deliv'd to most New England points:

*Buffalo, sil. 1.75 to 2.25	$21.91 to $22.41
*Buffalo, sil. 2.25 to 2.75	21.91 to 22.41
East. Penn., sil. 1.75 to 2.25	22.65 to 23.15
East. Penn., sil. 2.25 to 2.75	23.15 to 23.65
Va., sil. 1.75 to 2.25	25.21
Va., sil. 2.25 to 2.75	25.71
*Ala., sil. 1.75 to 2.25	24.11
*Ala., sil. 2.25 to 2.75	24.61
†Ala., sil. 1.75 to 2.25	20.25
†Ala., sil. 2.25 to 2.75	20.75

Freight rates; $4.91 all rail from Buffalo; $3.65 all rail from eastern Pennsylvania; $5.21 all rail from Virginia; $9.61 all rail from Alabama and $5.75 rail and water from Alabama to New England seaboard.

*All rail rate.

†Rail and water rate.

Pacific Coast

Revival of Demand for Cast Iron Pipe

SAN FRANCISCO, Dec. 28.—(*By Air Mail*)—During the past year bookings of cast iron pipe, plates and structural shapes and reinforcing steel bars in this territory exceeded the amounts for the previous year. The totals, in tons, are as follows:

	1929	1928
Cast iron pipe	71,744	70,589
Structural shapes and plates	424,758	172,107
Reinforcing steel bars	66,954	62,920

Evidence of a revival of demand for cast iron pipe is seen in the entrance into the market of Los Angeles

(*Continued on page* 122)

Non-Ferrous Metal Markets

Copper Quiet but Firm—Tin Inactive—Lead and Zinc Demand Good

NEW YORK, Dec. 30.

Copper.—Although buying, both foreign and domestic, is naturally very light as the year closes, producers feel confident that there will be decided activity early in January. Stocks are admittedly very low. Already some consumers have placed orders for shipment as early as Jan. 2. While activity in the brass industry is not entirely satisfactory, producers of copper sheet and wire seem to have good order books. While some melters are covered for part of their January requirements, considerable metal must yet be purchased. Consumers abroad are not as well covered as they are in this country. Export sales in December were only around 27,000 tons, and for shipment in January only about 4000 tons has been engaged. Assuming January requirements over there to be at least 35,000 tons, it will be necessary for purchases for January shipment to total 30,000 tons more. Producers seem confident that there will be no change in prices for some time. Electrolytic copper is quoted at 18c., delivered in the Connecticut Valley, and Copper Exporters, Inc., still maintain their price at 18.30c., c.i.f., usual European ports. Lake copper is steady, at 18c. to 18.12½c., delivered.

Tin.—With the London markets closed frequently during the holiday season, activity here in tin has been very light. There has been almost no buying. Transactions on the National Metal Exchange were fairly brisk on Dec. 27, but were of no particular significance. Prices have been steady, around 39.25c. to 40c., with the quotation today for spot Straits tin at 39.30c., New York. On the London Metal Exchange today prices were lower than a week ago in a very dull market, spot standard being quoted at £175 2s. 6d., future standard at £178 12s. 6d., and spot Straits at £177 12s. 6d. The Singapore price was £182 5s.

Lead.—It is estimated that about one-third of the January requirements has been purchased by consumers and almost nothing booked for February. The past week has naturally been inactive, but heavy buying is confidently expected after the turn of the year. Prices are firm at 6.10c., St. Louis, with the quotation of the leading in-

THE WEEK'S PRICES. CENTS PER POUND FOR EARLY DELIVERY

	Dec. 30	Dec. 28	Dec. 27	Dec. 26	Dec. 24
Lake copper, New York	18.12½	18.12½	18.12½	18.12½	18.12½
Electrolytic copper, N. Y.*	17.75	17.75	17.75	17.75	17.75
Straits tin, spot, N. Y.	39.30	....	39.25	39.87½	39.75
Zinc, East St. Louis	5.45	5.45	5.45	5.45	5.45
Zinc, New York	5.80	5.80	5.80	5.80	5.80
Lead, St. Louis	6.10	6.10	6.10	6.10	6.10
Lead, New York	6.25	6.25	6.25	6.25	6.25

*Refinery quotation; price ¼c. higher delivered in the Connecticut Valley.

Rolled Products

List Prices, Per Lb., f.o.b. Mill

On Copper and Brass Products, Freight up to 75c. per 100 Lb. Allowed on Shipments of 500 Lb. or Over

Sheets—
- High brass ..... 23.25c.
- Copper, hot rolled ..... 26.75c.
- Zinc ..... 10.50c.
- Lead (full sheets) ..... 10.00c.

Seamless Tubes—
- High brass ..... 28.25c.
- Copper ..... 29.25c.

Rods—
- High brass ..... 21.25c.
- Naval brass ..... 24.00c.

Wire—
- Copper ..... 19.87½c.
- High brass ..... 23.75c.

Copper in Rolls ..... 26.75c.

Brazed Brass Tubing ..... 30.87½c.

Aluminum Products in Ton Lots

The carload freight rate is allowed to destinations east of Mississippi River and also to St. Louis on shipments to points west of that river.

- Sheets, 0 to 10 gage, 3 to 30 in. wide ..... 33.00c.
- Tubes, base ..... 42.00c.
- Machine rods ..... 34.00c.

Chicago Warehouse

(Prices Cover Trucking to Customers' Doors in City Limits)

	Base per Lb.
Sheets—	
High brass	23.25c.
Copper, hot rolled	27.75c.
Copper, cold rolled, 14 oz. and heavier	30.00c.
Zinc	10.75c.
Lead, wide	10.30c.
Seamless Tubes—	
Brass	28.25c.
Copper	29.25c.
Brass Rods	21.25c.
Brazed Brass Tubes	31.00c.

New York or Cleveland Warehouse

Delivered Prices, Base per Lb.

High brass	21.12½c.	to 22.12½c.
Copper, hot rolled, base sizes	27.75c.	to 28.75c.
Copper, cold rolled, 14 oz. and heavier, base sizes	30.00c.	to 31.00c.
Seamless Tubes—		
Brass	26.00c.	to 27.00c.
Copper	29.12½c.	to 30.12½c.
Brass Rods	18.87½c.	to 19.87½c.
Brazed Brass Tubes	29.12½c.	to 30.12½c.

New York Warehouse

Delivered Prices, Base per Lb.

Zinc sheets (No. 9), casks	10.75c. to 11.25c.
Zinc sheets, open	11.50c. to 12.00c.

Metals from New York Warehouse

Delivered Prices, Per Lb.

Tin, Straits pig	41.50c. to 42.50c.
Tin, bar	43.50c. to 44.50c.
Copper, Lake	19.50c.
Copper, electrolytic	19.25c.
Copper, casting	19.00c.
Zinc, slab	6.75c. to 7.25c.
Lead, American pig	7.00c. to 7.50c.
Lead, bar	9.00c. to 9.50c.
Antimony, Asiatic	10.50c. to 11.00c.
Aluminum No. 1 ingots for remelting (guaranteed over 99% pure)	25.00c. to 26.00c.
Alum. ingots, No. 12 alloy	24.00c. to 25.00c.
Babbitt metal, commercial grade	25.00c. to 35.00c.
Solder, ½ and ½	27.50c. to 28.50c.

Metals from Cleveland Warehouse

Delivered Prices, Per Lb.

Tin, Straits pig	44.50c.
Tin, bar	46.50c.
Copper, Lake	19.50c.
Copper, electrolytic	19.25c.
Copper, casting	18.75c.
Zinc, slab	8.00c. to 8.25c.
Lead, American pig	7.00c. to 7.20c.
Lead, bar	9.25c.
Antimony, Asiatic	16.00c.
Babbitt metal, medium grade	18.00c.
Babbitt metal, high grade	47.00c.
Solder, ½ and ½	28.50c.

Old Metals, Per Lb., New York

Buying prices represent what large dealers are paying for miscellaneous lots from smaller accumulators and selling prices are those charged consumers after the metal has been properly prepared for their uses.

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	14.75c.	16.00c.
Copper, hvy. and wire	14.50c.	15.50c.
Copper, light and bottoms	12.50c.	13.50c.
Brass, heavy	8.00c.	9.00c.
Brass, light	6.75c.	7.75c.
Hvy. machine composition	11.00c.	12.00c.
No. 1 yel. brass turnings	9.00c.	9.50c.
No. 1 red brass or compos. turnings	10.50c.	11.75c.
Lead, heavy	4.75c.	5.25c.
Lead, tea	3.75c.	4.25c.
Zinc	3.25c.	3.75c.
Sheet aluminum	11.00c.	13.00c.
Cast aluminum	10.00c.	12.00c.

terest unchanged at 6.25c., New York, as the contract price.

Zinc.—Convinced that slab zinc has reached its lowest level, consumers have been buying quite liberally for shipment in January and February. Prices are unchanged from a week ago, at 5.45c., East St. Louis, or 5.80c., New York. The outlook for the industry is better than it has been for some weeks.

Antimony.—With buying in small volume Chinese metal is easier, at 8.12½c., New York, duty paid, for spot and future delivery.

Nickel.—Wholesale lots of ingot nickel are quoted at 35c. per lb., with shot nickel at 36c. and electrolytic nickel in cathodes at 35c.

Aluminum.—Virgin metal, 98 to 99 per cent pure, is quoted at 23.90c. per lb., delivered.

Non-Ferrous Metals in Chicago

CHICAGO, Dec. 30.—Sales have been in fair volume in a market in which prices, except for tin and antimony, have been steady. The old metal market is quiet.

Prices per lb., in carload lots: Lake copper, 18.50c.; tin, 40.10c; lead, 6.20c.; zinc, 5.60c.; in less-than-carload lots, antimony, 9.50c. On old metals we quote copper wire, crucible shapes and copper clips, 14c.; copper bottoms, 11.50c.; red brass, 11.50c.; yellow brass, 8c.; lead pipe, 4.50c.; zinc, 3c.; pewter, No. 1, 24.50c.; tin foil, 22c.; block tin, 32c.; aluminum, 12.87½c.; all being dealers' prices for less-than-carload lots.

Deliveries of Non-Ferrous Ingots in November

CHICAGO, Dec. 30.—The combined deliveries of brass and bronze ingots and billets by the members of the Non-Ferrous Ingot Metal Institute for the month of November amounted to 6134 tons.

Ford Plans $30,000,000 Plant Expansion

During 1930 the Ford Motor Co. will spend more than $20,000,000 for new buildings and additions to plant and in excess of $10,000,000 for new equipment, according to plans announced by Edsel B. Ford.

The expenditures will be made in various sections of the United States, and are exclusive of new outlays by affiliated plants in foreign countries. Several of the expansion programs will affect plants on the Atlantic and Pacific coasts.

Producers of non-ferrous ingot metal representing more than 75 per cent of the national production will hold a trade practice conference under the auspices of the Federal Trade Commission. Commissioner G. S. Ferguson, Jr., will preside at the meeting. No time or place for the session has been determined.

Iron and Steel Markets

(*Continued from page* 120)

for 2753 tons and of Newport Beach, Cal., for 736 tons. Features of the week included the opening of bids on 5200 tons of plates for a pipe line at San Diego, on which the Western Pipe & Steel Co. was low bidder and the award of 1338 tons of shapes for the San Luis Rey River bridge near San Diego to the United States Steel Products Co.

Pig Iron.—Both sales and inquiries for foundry pig iron were confined to small lots. Little buying is now looked for until the latter part of January. Prices are unchanged.

Prices per gross ton at San Francisco:

*Utah basic	$25.00 to $26.00
*Utah fdy., sil. 2.75 to 3.25	25.00 to 26.00
**Indian fdy., sil. 2.75 to 3.25	25.00 to 26.00

*Delivered San Francisco.
**Duty paid, f.o.b. cars San Francisco.

Birmingham

Larger Melt of Pig Iron Expected Soon

BIRMINGHAM, Dec. 30.—Several of the larger melters, though not in immediate need of pig iron, have expressed confidence in the market, thus adding to the general feeling that the recently established base price of $15 for the first quarter will hold. Buying is expected to be resumed this week, supported largely by small consumers whose stocks are low. Prospects are favorable for an increase in the melt within the next few weeks. This, together with the fact that buying for the new quarter has been delayed longer than usual, makes producers hopeful for a steady improvement in the market during the month. Numerous instructions have been received to resume shipments this week. The No. 2 Vanderbilt furnace of the Woodward Iron Co. was blown out Dec. 22. On the same date the No. 3 Woodward furnace of this company was banked, supposedly for the holiday period. This leaves 14 active furnaces in the district. Of this number, seven are on foundry iron, six on basic and one on recorburizing iron.

Prices per gross ton, f.o.b. Birmingham dist. furnaces:

No. 2 fdy., 1.75 to 2.25 sil.	$14.50 to $15.00
No. 1 fdy., 2.25 to 2.75 sil.	15.00 to 15.50
Basic	14.50 to 15.00

Safety Officers Chosen

The Power Press Section of the National Safety Council, Chicago, recently elected the following officers: Chairman, S. H. Slaymaker, Fairbanks, Morse & Co., Beloit, Wis.; vice-chairman in charge of program, R. G. Marter, National Enameling & Stamping Co., Milwaukee; secretary, W. J. Larson, Clum Mfg. Co., Milwaukee. The news-letter editor will be J. B. Gibson, Western Electric Co., Chicago.

Cincinnati

Pig Iron Demand Still Slow

CINCINNATI, Dec. 30.—While the pig iron trade is optimistic about business after the first of the year, demand is still sluggish. In fact, there is no inquiry before the trade for any sizable quantity of iron. Last week's sales included 2400 tons of foundry iron and 1000 tons of low phosphorus. Of the foundry iron sold, about 1000 tons was Southern iron. A northern Ohio buyer took 300 tons of Southern and 100 tons of Northern iron. A northern Indiana consumer bought 600 tons of Southern iron.

Prices per gross ton, deliv'd Cincinnati:

So. Ohio fdy., sil. 1.75 to 2.25	$19.89 to $20.39
Ala. fdy., sil. 1.75 to 2.25	17.69 to 18.19
Ala. fdy., sil. 2.25 to 2.75	18.19 to 18.69
Tenn. fdy., sil. 1.75 to 2.25	17.69 to 18.19
S'th'n Ohio silvery, 8 per cent	26.89

Freight rates, $1.89 from Ironton and Jackson, Ohio; $3.69 from Birmingham.

Finished Material.—With district sheet mills closed for the usual holiday vacation and repairs, the district sheet market has been very quiet. Mills report that fresh bookings, together with releases on previous orders, will be sufficient to start operations after New Year's Day at about 70 to 75 per cent of capacity. Automobile manufacturers are beginning to show increased interest in covering for their needs.

Old Material.—The movement of scrap is negligible. Despite the lack of business, prices are steady.

Dealers' buying prices per gross ton, f.o.b. cars, Cincinnati:

Heavy melting steel	$12.00 to $12.50
Scrap rails for melting	13.00 to 13.50
Loose sheet clippings	8.00 to 8.50
Bundled sheets	10.75 to 11.25
Cast iron borings	8.25 to 8.75
Machine shop turnings	8.00 to 8.50
No. 1 busheling	10.00 to 10.50
No. 2 busheling	6.50 to 7.00
Rails for rolling	13.50 to 14.00
No. 1 locomotive tires	14.25 to 14.75
No. 2 railroad wrought	12.00 to 12.50
Short rails	17.50 to 18.00
Cast iron carwheels	12.00 to 12.50
No. 1 machinery cast	18.50 to 19.00
No. 1 railroad cast	15.00 to 15.50
Burnt cast	10.00 to 10.50
Stove plate	10.00 to 10.50
Brake shoes	10.00 to 10.50
Agricultural malleable	14.00 to 14.50
Railroad malleable	15.00 to 15.50

Warehouse Prices, f.o.b. Cincinnati

	Base per Lb.
Plates and struc. shapes	3.40c.
Bars, soft steel or iron	3.30c.
New billet reinforc. bars	3.15c.
Rail steel reinforc. bars	3.00c.
Hoops	4.05c.
Bands	3.50c.
Cold-fin. rounds and hex	3.85c.
Squares	4.35c.
Black sheets (No. 24)	4.05c.
Galvanized sheets (No. 24)	4.90c.
Blue ann'l'd sheets (No. 10)	3.45c.
Structural rivets	3.85c.
Small rivets	65 per cent off list
No. 9 ann'l'd wire, per 100 lb	$3.00
Com. wire nails, base per keg	2.85
Cement c't'd nails, base 100 lb. keg	2.85
Chain, per 100 lb.	8.75
	Net per 100 Ft.
Lap-welded steel boiler tubes, 2-in.	$16.50
4-in.	34.50
Seamless steel boiler tubes, 2-in.	17.50
4-in.	36.00

Record Steel Production of 1929

(*Continued from page 6*)

ingot capacity, including the facilities of the Great Lakes Company which are not yet completed.

Of striking interest also was the invasion of the Pacific Coast territory by the United States Steel Corporation and the Bethlehem Steel Corporation. The Steel Corporation bought the Columbia Steel Corporation of California in late October, and early in December the Bethlehem Company announced the purchase of the Pacific Coast Steel Co. of San Francisco and its subsidiary, the Southern California Iron & Steel Co. In both instances the acquisitions were announced as having been made because of the growing importance of the Pacific Coast as a steel-consuming section, and also because of certain export advantages in Far East trade.

Another steel merger early in the year was that of the Allegheny Steel Co. and West Penn Steel Co., both of Brackenridge, Pa. The Republic Iron & Steel Co. and Spang, Chalfant & Co. jointly acquired control of the Fretz-Moon Co., Butler, Pa., maker of electrically welded steel tubing; the Wheeling Steel Corporation bought the Tyler Tube & Pipe Co., Washington, Pa., and the Corrigan-McKinney Steel Co. bought the N. & G. Taylor Co., Philadelphia, maker of tin plate.

In the pig iron industry there were two important consolidations. The Interlake Iron Co. was formed by the By-Products Coke Corporation, Chicago; the Zenith Furnace Co., Duluth, Minn.; the Toledo Furnace Co., Toledo, Ohio, and the Perry Iron Co., Erie, Pa. Earlier in the year the Davison Coke & Iron Co., Pittsburgh, acquired under lease the Cherry Valley blast furnace of the Hanna Furnace Co., Leetonia, Ohio, and the Claire furnace of the Reliance Coke & Furnace Co., Sharpsville, Pa.

In the steel castings industry the formation of the General Steel Castings Corporation, Philadelphia, by the Baldwin Locomotive Works, the American Locomotive Co. and the American Steel Foundries, with the addition of the Commonwealth Steel Co., Granite City, Ill., was of outstanding interest, but there were a number of others.

The bolt and nut industry had three important mergers, one of which brought together the Pittsburgh Screw & Bolt Corporation and the Graham Bolt & Nut Co. of Pittsburgh and the Colona Mfg. Co. of Colona, Pa. Another joined the Lamson & Sessions Co. and the Lake Erie Bolt & Nut Co., both of Cleveland, the latter having previously taken over the American Bolt Co., Birmingham. A third effected a union of the Superior Screw & Bolt Mfg. Co., Cleveland, and the Federal Screw Works, Detroit.

Mergers in the steel industry are looked upon as a means of reducing distribution costs, producing costs having already been subjected to considerable pressure during the past few years.

Earnings Were of Record Peace-Time Proportions

THE prosperity of the steel industry in the past year was reflected in its earnings, which were of record peace-time proportions. In all cases a substantial gain was made over 1928, and in some instances it was little short of phenomenal. Even though there was a sharp letdown in operations during the fourth quarter, profits for the year rose to a new post-war peak.

This remarkable showing is attributed to a consistently heavy demand for the leading steel products during the first three quarters, resulting in near-capacity operations for the industry. Naturally, the position of the mills was so favorable that prices were not only relatively stable during most of the year, but also somewhat higher than in 1928.

Foremost among the companies reporting large earnings was the United States Steel Corporation. Its profits during the first nine months of the year were equivalent to 15.82 per cent on the common shares outstanding as compared with 8.17 per cent for the same period of 1928. Its earnings for the year are estimated at $18 to $19 a share. Total earnings for the first three quarters were $202,274,555 as against $140,015,494 in 1928. The directors of the corporation gave the stockholders a chance to participate in the large profits by voting an extra dividend of $1 a share in connection with the regular dividend for the third quarter.

The capital structure of the corporation was expanded during the year. Starting in January with 7,116,235 shares of common stock, in April it offered rights at $140 a share in the ratio of one share of stock for every seven held. This resulted in an increase to 8,131,071 shares at the end of the third quarter. Payment for the Columbia Steel Corporation was made with some 233,400 shares, so that the total outstanding at the end of the year was approximately 8,364,500 shares.

Independents Show Large Gains

The Bethlehem Steel Corporation also showed a large gain over 1928 with profits in the first nine months of $32,196,783, the equivalent of $13.30 a share on the common stock. Its net income in the third quarter alone was more than three times that in the same period of the preceding year. Bethlehem, like the Steel Corporation, expanded its capital structure during the year by offering in June 600,000 shares of common stock to stockholders at $85 a share and in October 800,000 shares at $110. At the end of the year it had outstanding 3,200,000 shares and net earnings on this capitalization are expected to be about $12 for the year.

Earnings of the Youngstown Sheet & Tube Co. in the first nine months of 1929 were $17,294,114, or $16.67 a share on the common stock. This was a tremendous increase over the $6,873,372 for the same months of 1928. In July the company's stockholders voted a 20 per cent stock dividend, payable Oct. 1, so that the company now has outstanding 1,200,000 shares of common stock. On the basis of the greater capitalization it is anticipated that the company's earnings for the year were around $19 a share.

The Republic Iron & Steel Co., recently included in the consolidation known as the Republic Steel Corporation, showed net profits in the first nine months of $8,667,530, which is equivalent to $8.41 a share, as against $2,821,962 in the same period of 1928. Republic began the year with 690,891 shares of common stock, but its expansion program brought the number up to 874,630 shares in October. With the latter number of shares taken as a basis, its earnings in 1929 probably were about $10 a share.

Net income of the Jones & Laughlin Steel Corporation in the first nine months was $16,995,913, compared with $11,649,453 in the same months of the previous year. In connection with its regular third quarter dividend the board of directors voted a 1 per cent cash dividend on the common stock.

Earnings of the Inland Steel Co. from January to September, inclusive, amounted to $9,293,118, or $7.74 a share on its common stock, as contrasted with $5.53 a

share in the corresponding months of 1928. Net profits for the year should run close to $9 a share.

The Wheeling Steel Corporation had net profits for the first nine months of $5,912,919, as compared with $3,963,009 in the same period of 1928.

Exports Increase While Imports Are Reduced

LAST year at this time we were able to report a considerable increase in iron and steel shipments from the United States to foreign countries, as compared with a slight increase in the preceding year, and at the same time to report an approximately stationary condition in imports. The year 1929 shows another good increase in exports, with a moderate decline in imports, as revealed by the figures of the first 11 months.

Exports to Nov. 30 are reported at a total of 2,817,110 gross tons, or only 45,887 tons under the total for 12 months in 1928, amounting to 2,862,997 tons, which was the largest annual movement since 1920. If we exclude scrap, which has shown a moderate reduction compared with a year ago, the net exports in 10 months have been 2,134,947 tons, against 1,921,311 tons in 1928, the gain being 11 per cent. Correspondingly, imports in 11 months have been 691,433 tons, against 727,310 tons for the corresponding period of 1928. This reduction is almost 5 per cent.

Comparing figures for rolled and finished steel available at this writing, we find in the first 10 months of 1929 outgoing shipments amounting to 1,806,290 tons, against 1,607,630 tons in 1928 and 1,429,017 tons in 1927. The gain in 1929 has been more than 12 per cent. In imports, however, there has been a sharp reduction, from 862,668 tons in 1928 to 287,159 tons in 10 months of last year. This decline is about 21 per cent.

Principal among the increases in exports in the first 10 months of 1929 compared with 1928 are steel bars, which gained almost 50,000 tons; steel plates, increasing 40,000 tons; plain structural shapes, which went up 75,000 tons, together with 23,000 tons increase in fabricated structural material; black and galvanized pipe, gaining 26,000 tons; galvanized sheets, up 9000 tons; and hoops, bands and strip steel, 13,000 tons above a year earlier. Tin plate went up 14,000 tons. Against this considerable gain the only loss, to any extent, is in exports of steel rails, which dropped off 45,000 tons, or about 26 per cent.

Imports in 10 months showed relatively smaller losses in most items. Bars, however, fell off 44,000 tons, to less than half the 1928 total. Structural shapes declined 14,000 tons; hoops, bands and cotton ties, 7000 tons; and rails and splice bars, 8000 tons. There was an increase of more than 5000 tons in semi-finished steel, an increase of 34,000 tons in imports of scrap and one of 16,000 tons in incoming ferromanganese. Ferrosilicon imports trebled, going from 2737 tons to 8421 tons.

Scrap, which has been so large a factor in exports in the last two or three years, dropped 23,000 tons, or 5 per cent, compared with 1928. It still represents the largest export single item, being about one-sixth of the total tonnage. Exports of pig iron were off by 20,000 tons in 10 months, this decline representing more than 31 per cent.

WHERE THE CHIEF EXPORTS WENT

AS has been the case for many years, Canada was the largest buyer of our products in 1929, taking about 41 per cent as in 1928, and comparing with about 39 per cent in both 1927 and 1926. Shipments to Canada and Newfoundland in the first 10 months of 1929 were 1,166,030 tons, a gain of 10 per cent on the 971,064 tons of 1928.

Japan, as for a long time, stood in second position, with 330,867 tons in 10 months. This was a drop of almost 6 per cent from 1928. Other shipments of our iron and steel exports, in order of total quantity, were: Italy, 96,925 tons; Mexico, 89,355 tons; Philippines, 85,845 tons; Argentina, 79,882 tons; Poland, 75,091 tons; China, 60,658 tons; Brazil, 60,634 tons; Venezuela, 59,121 tons; Cuba, 58,687 tons; Great Britain, 57,502 tons, and Dutch East Indies, 54,719 tons. No other country reached 50,000 tons, although Chile, with 49,724 tons, was close to it.

Rolled and finished steel accounted for 70 per cent of our exports in the first 10 months of 1929, showing a moderate increase over the 67 per cent of the same period of 1928 but markedly behind the 78 per cent of 1927 and 84½ per cent of 1926, when scrap exports were lighter.

Imports of rolled and finished steel, after a steady and almost uniform increase since 1921, showed a drop in 1929, as noted above. This is the first downward movement in the curve in the nine years in the diagram.

Canada had a good lead as the source of imports in the first 10 months, with a total of 125,624 tons, nearly doubling the 1928 total. Belgium, in second position, sent 114,877 tons, followed closely by Germany, with 111,472 tons. France was fourth, with 89,427 tons. Last year Belgium led, with France second and Germany third; Canada was fifth. Great Britain sent 61,091 tons in 1929; India, 53,117 tons and Netherlands, 17,772 tons—practically all pig iron. These seven countries, with Sweden (31,028 tons) and Norway (23,254 tons) made up 627,662 tons, or 98½ per cent of all imports.

NEW RECORD IN MACHINERY EXPORTS

Machinery exports in the first 10 months of 1929 made a larger total than has ever before been reached in the full 12 months of any year. The aggregate was $515,597,664. This represents an increase of 26 per cent over the $408,551,091 for the first 10 months of 1928. The previous record for a full year was that of 1928, with $497,155,457. There has been a steadily rising tide of machinery exports since the fall of 1921. Each successive calendar year has shown a substantial increase such that 1929, when the figures are all in, will represent about two and a half times the total of 1922 and more than twice the total of any year preceding 1919.

UNITED STATES EXPORTS OF IRON AND STEEL
(Gross Tons)

	1924	1925	1926	1927	1928	1929
Jan.	247,942	141,777	174,585	215,235	205,766	274,296
Feb.	164,820	102,299	157,187	166,129	185,915	259,711
Mar.	123,618	155,384	169,438	171,094	221,935	270,925
Apr.	131,276	155,375	194,449	192,339	215,184	277,580
May	154,136	150,612	173,418	202,708	267,890	261,516
June	163,770	136,847	159,506	184,364	262,052	247,811
July	137,481	139,861	194,717	190,502	253,336	270,532
Aug.	134,628	188,465	171,588	175,636	287,297	242,856
Sept.	135,979	136,791	182,071	166,352	228,056	222,408
Oct.	157,071	141,817	172,070	170,255	256,870	247,646
Nov.	123,577	171,134	219,830	177,928	256,886	241,829
Dec.	128,865	142,209	198,189	168,427	221,810	.....
	1,803,163	1,762,571	2,167,048	2,180,969	2,862,997	3,060,000*

*Estimated, as to December.

Iron ore imports in 1929 were the largest ever received. The total for the year, with December estimated as equal to November, was 3,120,000 gross tons. The 11-month total was 2,853,279 tons, which is higher than any full calendar year previously had furnished. The earlier record was in 1923, with 2,768,430 tons. Previous to that the record was in 1913, with 2,594,770 tons. Of the 1929 importations more than one-half came from Chile, and almost one-half of the remainder from Cuba, the respective tonnages in 11 months having been 1,512,628 and 590,350.

Imports of manganese ore have been the largest since 1926. In 11 months 308,633 tons has come in, indicating about 332,000 tons for the year, if December equals November. The total in 1926 was 354,223 tons. In 1928 it was only 209,809 tons.

Iron and Steel Prices for Sixteen Years

Monthly Averages Computed from the Weekly Market Quotations of THE IRON AGE in the Period of 1913 to 1929

IN this issue of THE IRON AGE are our two colored price charts, in which plotted lines indicate the course of prices for pig iron, billets, scrap and leading forms of finished iron and steel and non-ferrous metals in the 17 years ended with 1929. The diagrams are based on monthly averages of prices quoted week by week in our market reports from the leading selling centers. In the tables following are the monthly average prices of about 80 products, including those on which the charts are based.

Bessemer Pig Iron at Pittsburgh, per Gross Ton (2240 lb.)

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$18.15	$14.96	$14.59	$21.58	$35.95	$37.25	$33.60	$40.00	$33.96	$21.56	$29.27	$24.76	$24.64	$22.76	$21.26	$19.26	$20.01
Feb.	18.15	15.09	14.55	21.51	35.95	37.25	33.60	42.90	31.46	21.46	29.83	25.26	24.51	22.76	20.76	19.26	20.01
March	18.15	15.09	14.55	21.75	37.70	37.25	32.54	43.40	28.16	21.46	32.02	25.14	24.06	22.76	21.16	19.26	20.14
April	17.90	14.90	14.55	21.95	42.20	36.15	29.35	43.60	26.96	22.59	32.77	24.56	22.89	21.39	21.26	19.26	20.26
May	17.70	14.90	14.59	21.95	45.15	36.15	29.35	44.03	26.16	26.36	31.87	23.89	21.76	21.14	20.96	19.06	20.76
June	17.14	14.90	14.70	21.95	54.70	36.38	29.35	44.80	24.71	26.96	30.27	22.89	20.76	20.76	20.64	18.76	20.76
July	16.70	14.90	14.95	21.95	57.45	36.60	29.35	47.15	22.84	26.77	28.46	21.96	20.76	20.39	20.26	18.76	20.76
Aug.	16.52	14.90	15.95	21.95	54.75	36.60	29.35	49.11	21.96	29.96	28.26	21.76	20.76	19.76	20.16	18.76	20.76
Sept.	16.65	14.90	16.85	22.26	48.02	36.60	29.35	50.46	21.96	35.27	28.26	21.76	21.06	20.01	19.76	18.95	20.76
Oct.	16.60	14.84	16.95	24.08	37.25	36.60	29.35	49.16	21.96	35.17	26.96	21.76	21.39	20.89	19.76	19.31	20.76
Nov.	16.02	14.59	17.51	30.15	37.25	36.60	31.26	41.10	21.96	33.52	25.26	22.13	22.64	21.66	19.76	19.95	20.76
Dec.	15.77	14.70	19.65	35.68	37.25	36.60	36.65	36.96	21.96	29.90	24.64	23.66	22.76	21.64	19.39	20.01	20.76
Aver.	*17.12*	*14.89*	*15.78*	*23.90*	*43.64*	*36.67*	*31.09*	*44.39*	*25.34*	*27.58*	*28.68*	*23.29*	*22.33*	*21.33*	*20.46*	*19.22*	*20.54*

Basic Pig Iron, f. o. b. Mahoning or Shenango Valley Furnace, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.41	$12.50	$12.50	$17.81	$30.00	33.00	$30.00	$37.40	$30.00	$18.15	$25.80	$21.25	$22.00	$20.00	$18.00	$17.00	$17.50
Feb.	16.30	13.19	12.50	17.69	30.00	33.00	30.00	42.25	27.50	17.75	26.25	22.00	22.00	20.00	18.00	17.00	17.50
March	16.11	13.00	12.50	18.20	32.25	33.00	28.94	41.50	24.20	17.94	30.13	21.94	21.30	20.00	18.40	17.00	17.50
April	15.87	13.00	12.50	18.13	38.75	32.00	25.75	42.40	22.88	20.00	31.05	21.55	20.13	18.63	19.00	16.88	17.90
May	15.15	13.00	12.50	18.00	41.60	32.00	25.75	43.25	22.00	24.60	29.00	20.50	18.81	18.38	18.20	16.30	18.38
June	14.50	13.00	12.59	18.00	48.75	32.00	25.75	44.00	20.75	25.00	27.38	19.63	18.05	18.00	17.88	15.45	18.50
July	14.37	13.00	12.74	18.00	52.50	32.00	25.75	45.85	19.38	24.25	25.10	19.00	18.00	17.63	17.50	16.00	18.50
Aug.	14.06	13.00	14.06	18.00	51.20	32.00	25.75	48.10	18.20	26.60	24.75	19.00	18.00	17.50	17.30	16.00	18.50
Sept.	14.00	13.00	14.75	18.31	42.75	32.00	25.75	48.50	19.13	32.63	24.38	19.00	18.30	17.50	17.06	16.19	18.50
Oct.	13.90	12.81	15.00	19.88	33.00	33.00	25.75	43.75	19.19	30.90	23.50	19.00	18.63	18.00	17.00	17.10	18.50
Nov.	13.09	12.48	15.75	25.10	33.00	33.00	28.31	36.50	19.00	27.75	20.88	19.13	19.88	18.50	17.00	17.50	18.50
Dec.	12.71	12.50	17.50	30.00	33.00	33.00	34.25	33.00	18.63	24.81	21.00	20.90	20.00	18.50	17.00	17.50	18.50
Aver.	*14.71*	*12.87*	*13.74*	*19.76*	*38.90*	*32.50*	*27.65*	*42.21*	*21.74*	*24.20*	*25.81*	*20.24*	*19.59*	*18.55*	*17.70*	*16.66*	*18.19*

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.90	$13.75	$13.00	$18.50	$30.00	$33.00	$31.00	$40.00	$31.50	$18.90	$28.90	$23.70	$24.00	$23.00	$20.88	$18.50	$20.00
Feb.	17.31	14.00	13.00	18.50	32.00	33.00	31.00	42.25	29.00	19.00	29.75	24.50	24.00	23.00	20.25	18.50	20.00
March	17.25	14.25	12.95	18.70	36.00	33.00	29.94	43.00	25.60	20.00	31.25	24.38	23.80	23.00	20.00	18.50	20.00
April	17.00	14.25	13.00	19.00	39.25	33.00	26.75	43.00	24.00	20.50	32.00	24.10	22.50	22.00	20.00	18.50	20.00
May	16.00	14.06	13.00	19.00	43.80	33.00	26.75	43.00	22.80	22.60	32.00	22.75	21.13	21.63	20.00	18.20	20.00
June	15.62	13.69	13.00	19.00	51.00	33.00	26.75	43.40	20.75	23.25	31.25	21.25	20.30	21.10	20.00	18.00	20.00
July	14.70	13.75	13.00	19.00	55.00	33.00	26.75	45.25	19.00	24.25	27.90	19.60	20.50	21.00	20.00	17.60	20.00
Aug.	15.00	13.69	13.44	18.40	55.00	33.00	26.75	46.00	19.55	28.60	27.00	20.38	20.50	21.00	19.50	17.63	20.00
Sept.	15.00	13.25	13.90	18.13	54.67	33.00	26.75	46.00	21.75	32.00	26.75	20.50	21.00	21.00	19.50	18.25	20.00
Oct.	15.00	12.94	14.63	19.63	33.00	34.00	27.75	44.50	21.00	31.40	25.00	20.50	21.63	21.00	19.00	18.80	20.00
Nov.	14.87	12.56	17.13	25.80	33.00	34.00	31.00	39.40	20.60	29.75	23.13	21.00	22.75	21.00	18.50	20.00	20.00
Dec.	14.30	13.00	18.10	29.50	33.00	34.00	38.75	34.50	19.63	28.00	23.00	22.50	23.00	21.00	18.50	20.00	20.00
Aver.	*15.83*	*13.60*	*14.01*	*20.26*	*41.31*	*33.25*	*29.16*	*42.53*	*22.93*	*24.85*	*28.16*	*22.10*	*22.09*	*21.64*	*19.68*	*18.54*	*20.00*

Standard Brands Eastern Pennsylvania No. 2X Foundry Pig Iron at Philadelphia, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$18.25	$14.65	$14.25	$19.94	$30.10	$34.25	$36.15	$44.10	$33.34	$21.34	$29.76	$24.11	$25.01	$24.26	$22.76	$20.56	$21.76
Feb.	18.25	14.94	14.25	20.00	31.88	34.25	36.15	45.10	31.09	21.09	30.01	24.04	25.01	24.14	22.26	21.14	21.76
March	17.77	15.00	14.25	20.05	37.31	34.25	34.39	45.53	27.59	21.26	32.30	24.16	24.21	23.36	22.26	21.26	21.89
April	17.40	15.00	14.25	20.50	41.32	34.25	31.90	46.85	26.26	23.62	32.95	23.06	22.82	23.26	22.26	21.26	22.26
May	16.75	14.81	14.25	20.50	43.60	34.25	30.70	47.10	25.71	26.09	32.76	22.67	21.51	22.89	22.26	21.36	22.26
June	16.19	14.75	14.25	19.94	48.19	34.29	29.50	47.15	25.50	27.06	30.76	21.85	21.26	22.66	22.14	21.26	22.26
July	15.60	14.75	14.31	19.75	53.13	34.40	29.08	48.15	23.55	27.92	27.68	21.26	21.26	22.26	21.51	20.86	22.16
Aug.	15.60	14.75	14.94	19.55	53.00	34.40	29.60	51.96	20.64	32.26	25.89	21.51	21.57	22.26	21.26	20.76	21.76
Sept.	15.83	14.75	16.00	19.50	51.67	34.40	30.70	53.51	21.22	34.83	26.26	21.76	21.96	22.26	20.76	21.01	21.76
Oct.	15.95	14.63	16.25	20.31	34.25	38.85	32.10	52.53	22.23	32.54	24.04	21.76	22.64	22.26	20.51	21.26	21.76
Nov.	15.56	14.50	17.12	24.90	34.25	39.15	35.35	44.99	22.74	30.39	23.01	22.64	23.64	23.56	20.26	21.64	21.76
Dec.	15.20	14.25	19.05	29.25	34.25	39.15	40.10	35.54	21.82	28.86	24.26	24.56	24.26	23.39	20.26	21.76	21.46
Aver.	*16.53*	*14.73*	*15.26*	*21.18*	*41.08*	*35.49*	*32.98*	*46.88*	*25.14*	*27.27*	*28.31*	*22.78*	*22.93*	*23.05*	*21.55*	*21.17*	*21.90*

Southern No. 2 Foundry Pig Iron at Cincinnati, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.95	$13.88	$12.40	$17.90	$26.10	$35.90	$34.60	$41.80	$36.75	$20.70	$27.45	$25.55	$24.05	$25.69	$22.19	$19.69	$20.19
Feb.	16.69	13.81	12.40	17.90	27.53	35.90	34.60	43.60	32.63	20.00	28.68	26.55	24.05	25.69	21.69	19.69	20.19
March	16.31	14.00	12.27	17.90	31.90	35.90	33.54	43.60	29.80	19.50	30.80	26.55	24.05	25.69	21.69	19.69	19.69
April	15.65	13.75	12.34	17.90	37.40	35.90	30.65	44.00	28.00	20.38	31.05	26.35	24.05	25.69	21.69	19.69	19.09
May	14.94	13.75	12.40	17.90	41.90	35.90	29.85	45.60	26.70	22.10	30.75	25.55	24.05	25.69	21.69	19.39	18.69
June	14.06	13.63	12.50	17.34	45.15	36.08	28.39	45.60	26.38	23.00	29.30	24.05	23.25	24.59	21.69	19.56	18.69
July	13.75	13.30	12.71	16.90	49.90	36.60	28.35	45.60	24.75	22.30	28.85	22.05	22.13	24.19	21.13	19.19	17.99
Aug.	14.06	13.25	13.71	16.70	49.90	36.60	30.40	45.78	23.50	24.36	27.68	21.55	22.55	24.19	20.94	19.39	17.57
Sept.	14.25	13.25	14.15	17.28	49.90	36.60	31.25	46.50	23.50	29.55	26.55	21.55	22.85	24.07	20.94	19.94	17.19
Oct.	14.35	12.90	14.78	18.03	49.38	37.60	31.60	46.50	23.50	30.85	24.68	21.55	23.43	23.69	20.94	19.94	17.39
Nov.	13.87	12.90	16.15	22.40	35.90	37.60	34.35	42.50	22.90	27.55	23.65	21.30	24.87	23.69	19.69	20.07	17.69
Dec.	13.95	12.50	17.10	25.90	35.90	37.60	38.60	42.50	21.75	26.93	25.05	23.85	25.49	23.69	19.69	20.19	17.69
Aver.	*14.90*	*13.41*	*13.58*	*18.67*	*40.07*	*36.52*	*32.16*	*44.47*	*26.68*	*23.93*	*27.87*	*23.91*	*23.74*	*24.71*	*21.16*	*19.70*	*18.51*

Mahoning and Shenango Valley, No. 2 Foundry Iron, at Furnace, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.50	$12.85	$13.00	$18.50	$31.00	$33.00	$31.00	$39.40	$31.88	$19.30	$27.00	$22.50	$22.38	$20.50	$18.50	$17.25	$17.50
Feb.	17.00	13.19	13.00	18.31	32.00	33.00	31.00	41.50	28.00	18.88	27.50	23.00	22.00	20.50	18.50	17.25	17.50
March	16.69	13.25	13.00	18.50	34.75	33.00	29.94	41.25	25.90	19.00	30.50	23.00	21.10	20.50	18.50	17.25	17.75
April	15.55	13.25	12.75	18.50	39.75	33.00	26.75	42.80	24.75	20.75	31.00	21.80	20.13	19.00	18.50	17.25	18.00
May	14.62	13.00	12.94	18.20	42.40	33.00	26.75	44.25	23.50	23.80	30.20	20.75	19.13	18.88	18.50	17.20	18.50
June	14.06	13.00	12.69	18.13	50.25	33.00	26.75	45.00	22.10	24.00	27.63	19.63	18.30	17.96	18.13	16.75	18.50
July	13.87	13.00	12.70	18.25	54.50	33.00	26.75	45.00	20.13	24.25	25.50	19.00	18.50	17.69	18.00	16.65	18.50
Aug.	14.00	13.00	13.62	18.25	53.20	33.00	26.75	47.00	19.63	32.60	24.88	19.13	18.50	17.50	17.60	16.50	18.50
Sept.	14.00	13.00	14.70	18.39	47.00	33.00	26.75	49.40	21.00	34.88	24.75	19.80	18.80	17.63	17.50	16.88	18.50
Oct.	13.84	12.90	14.87	20.00	33.00	34.00	26.75	46.50	21.00	31.80	23.60	19.50	19.13	18.50	17.50	17.10	18.50
Nov.	13.50	12.75	15.50	25.00	33.00	34.00	31.50	40.25	20.75	27.88	21.88	19.50	20.39	19.00	17.45	17.63	18.50
Dec.	13.50	12.75	18.30	30.75	33.00	34.00	36.75	36.20	20.00	25.63	22.00	21.20	20.50	18.80	17.25	17.70	18.50
Aver.	*14.84*	*13.00*	*13.92*	*20.07*	*40.32*	*33.25*	*28.95*	*43.21*	*23.22*	*25.23*	*26.37*	*20.73*	*19.90*	*18.87*	*18.00*	*17.12*	*18.23*

Gray Forge Pig Iron, Philadelphia and Vicinity, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.65	$14.00	$13.50	$18.44	$28.38	$32.00	$33.90	$40.23	$32.78	$20.60	$27.85	$22.81	$24.00	$23.00	$21.50	$19.65	$20.50
Feb.	17.31	14.00	13.44	19.00	29.75	32.00	33.90	40.50	30.90	20.50	28.37	22.50	23.63	23.00	21.19	19.75	20.50
March	16.87	14.00	13.25	19.00	31.94	32.00	32.84	43.00	26.86	20.50	29.62	22.12	23.40	22.30	21.00	19.75	20.50
April	16.56	14.00	13.25	19.13	38.50	32.00	29.65	43.00	25.26	21.25	30.37	22.00	22.63	22.00	21.00	19.75	20.50
May	15.81	13.81	13.25	19.50	40.40	32.00	29.21	43.00	25.26	23.80	29.50	22.00	21.50	22.00	21.00	19.75	20.50
June	15.37	13.75	13.25	19.25	44.31	32.00	26.25	43.00	24.69	24.25	28.00	22.00	21.50	21.90	21.00	19.75	20.50
July	14.95	13.75	13.25	18.50	50.05	32.00	25.92	43.00	22.50	25.50	26.90	21.20	21.50	21.50	21.00	19.75	20.50
Aug.	14.62	13.75	14.50	18.50	49.56	32.00	26.60	45.46	21.20	29.00	25.50	21.00	21.00	21.40	20.60	19.75	20.00
Sept.	14.56	13.75	15.13	18.50	44.25	32.00	27.00	47.10	20.00	31.00	25.50	21.00	21.00	21.00	20.50	19.75	20.00
Oct.	15.00	13.62	15.25	19.35	32.20	36.60	28.69	47.10	20.50	31.00	24.20	21.00	21.25	21.00	20.25	19.75	20.00
Nov.	14.75	13.50	16.05	23.75	32.00	36.60	32.40	44.64	22.50	29.14	23.00	21.37	22.00	22.50	19.50	20.00	20.00
Dec.	14.58	13.50	17.63	27.69	32.00	36.90	36.10	38.74	21.69	28.14	23.00	23.10	23.00	22.50	19.50	20.50	20.00
Aver.	*15.67*	*13.79*	*14.31*	*20.05*	*37.78*	*33.18*	*30.21*	*43.23*	*24.51*	*25.39*	*26.82*	*21.84*	*22.20*	*22.01*	*20.67*	*19.82*	*20.29*

Malleable Pig Iron at Chicago, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.90	$13.88	$13.00	$19.00	$30.94	$33.50	$31.50	$40.50	$32.00	$18.90	$28.90	$23.88	$24.00	$23.00	$20.88	$18.50	$20.00
Feb.	17.31	13.94	13.00	19.00	31.75	33.50	31.50	42.75	29.38	19.13	29.75	24.50	24.00	23.00	20.25	18.50	20.00
March	17.25	14.25	13.00	19.40	35.40	33.50	30.44	43.50	25.80	20.00	31.25	24.38	24.00	23.00	20.00	18.50	20.00
April	17.05	14.25	13.00	19.50	39.00	33.50	27.25	43.50	24.00	20.50	32.00	24.10	22.63	22.00	20.00	18.50	20.00
May	16.00	14.06	13.00	19.50	43.60	33.50	27.25	43.50	23.00	22.60	32.00	22.75	21.25	21.42	20.00	18.22	20.00
June	15.62	13.88	13.00	19.50	50.25	33.50	27.25	43.50	21.50	23.25	31.25	21.25	20.60	21.10	20.00	18.00	20.00
July	14.65	14.00	13.00	19.50	55.00	33.50	27.25	45.25	19.00	24.25	27.90	19.60	20.50	21.00	20.00	17.60	20.00
Aug.	15.00	14.00	13.44	19.00	55.00	33.50	27.25	46.50	19.60	28.60	27.00	20.38	20.50	21.00	19.50	17.63	20.00
Sept.	15.00	13.25	14.30	19.00	54.75	33.50	27.25	46.50	21.75	32.00	26.75	20.50	21.00	21.00	19.50	18.25	20.00
Oct.	15.20	13.00	15.25	19.88	33.50	34.50	28.25	45.75	21.00	31.40	25.00	20.50	21.63	21.00	19.00	18.80	20.00
Nov.	14.87	12.88	17.13	25.80	33.50	34.50	31.50	39.90	20.60	29.75	23.13	20.88	22.75	21.00	18.50	20.00	20.00
Dec.	14.63	12.90	18.20	29.50	33.50	34.50	39.50	35.00	19.63	28.00	23.00	22.62	23.00	21.00	18.50	20.00	20.00
Aver.	*15.87*	*13.69*	*14.11*	*20.72*	*41.35*	*33.75*	*29.68*	*43.01*	*23.11*	*24.87*	*28.16*	*22.11*	*22.15*	*21.63*	*19.68*	*18.54*	*20.00*

Lake Superior Charcoal Pig Iron at Chicago, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$18.15	$15.25	$15.75	$19.50	$31.75	$37.50	$38.85	$48.75	$42.50	$31.10	$33.15	$29.15	$29.04	$29.04	$27.04	$27.04	$27.04
Feb.	18.00	15.25	15.75	19.75	33.75	37.50	38.85	58.38	39.50	29.38	33.90	29.15	29.04	29.04	27.04	27.04	27.04
March	18.00	15.25	15.75	19.75	36.75	37.50	38.85	58.20	38.50	26.00	35.40	29.15	29.04	29.04	27.04	27.04	27.04
April	18.00	15.45	15.75	19.75	40.25	37.50	31.75	57.25	38.50	26.50	36.53	29.15	29.04	29.04	27.04	27.04	27.04
May	18.00	15.75	15.75	19.75	48.15	37.50	31.75	57.50	37.50	28.40	36.65	29.15	29.04	29.04	27.04	27.04	27.04
June	16.81	15.75	15.75	19.75	52.88	37.62	31.75	57.50	37.50	29.75	36.65	29.12	29.04	29.04	27.04	27.04	27.04
July	15.65	15.75	15.75	19.75	57.75	38.00	31.75	57.50	36.37	31.65	34.81	29.04	29.04	29.04	27.04	27.04	27.04
Aug.	14.69	15.75	16.00	19.75	58.00	38.00	32.25	57.70	33.60	34.05	32.04	29.04	29.04	29.04	27.04	27.04	27.04
Sept.	15.25	15.75	15.85	19.75	58.00	38.00	32.75	58.50	33.00	36.15	32.04	29.04	29.04	29.04	27.04	27.04	27.04
Oct.	15.25	15.75	15.75	20.25	37.50	38.00	33.44	58.50	31.50	36.15	29.86	29.04	29.04	27.54	27.04	27.04	27.04
Nov.	15.25	15.75	17.00	26.46	37.50	38.70	38.50	55.75	31.50	36.15	28.40	29.04	29.04	27.04	27.04	27.04	27.04
Dec.	15.25	15.75	18.65	31.75	37.50	38.70	43.00	49.13	31.50	34.65	29.15	29.04	29.04	27.04	27.04	27.04	27.04
Aver.	*16.53*	*15.60*	*16.13*	*21.33*	*44.15*	*37.88*	*35.29*	*56.22*	*35.96*	*31.66*	*33.22*	*29.09*	*29.04*	*28.58*	*27.04*	*27.04*	*27.04*

No. 2 Foundry Pig Iron at Cleveland, (Delivered Consumer) per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.87	$13.50	$13.44	$19.30	$31.10	$33.30	$31.40	$40.00	$33.40	$20.06	$27.87	$23.70	$23.87	$22.32	$19.50	$18.50	$19.50
Feb.	17.53	13.82	13.50	19.23	32.93	33.30	31.40	41.90	30.22	20.06	29.00	24.50	23.99	22.38	19.13	18.50	19.50
March	17.16	14.25	13.47	19.05	37.06	33.30	30.58	43.15	27.80	21.55	32.15	24.50	23.47	21.81	19.90	18.50	19.50
April	16.39	14.25	13.38	19.36	40.27	33.30	27.15	43.40	26.62	20.81	32.52	24.25	22.82	20.85	19.87	18.50	19.50
May	15.62	14.38	13.38	19.45	42.90	33.30	27.15	44.53	25.50	23.75	32.21	23.25	20.87	20.00	19.50	18.50	19.50
June	14.96	14.25	13.28	19.07	50.63	33.32	27.15	44.90	24.00	24.06	30.46	21.50	20.12	19.69	19.20	18.39	19.50
July	14.69	13.75	13.20	18.79	55.80	33.40	27.15	45.20	21.31	24.75	27.44	20.25	20.00	19.50	19.00	18.00	19.50
Aug.	14.68	13.75	14.32	18.76	55.17	33.40	27.40	48.06	20.50	31.31	26.40	20.56	20.00	19.50	19.00	18.00	19.50
Sept.	14.75	13.75	15.27	18.92	53.15	33.40	27.65	49.86	20.75	35.94	25.87	20.81	20.00	19.50	19.00	18.39	19.50
Oct.	14.83	13.73	15.43	20.12	33.30	34.40	28.15	47.88	20.75	34.09	25.25	21.00	20.55	19.87	18.88	18.63	19.50
Nov.	14.40	13.51	16.61	26.20	33.30	34.40	31.90	43.46	20.56	30.47	23.35	21.31	22.32	20.60	18.50	19.50	19.50
Dec.	13.78	13.27	18.18	31.13	33.30	34.40	36.90	36.32	19.95	27.25	23.06	22.39	22.26	20.39	18.50	19.50	19.50
Aver.	*15.56*	*13.85*	*14.46*	*20.78*	*41.58*	*33.60*	*29.67*	*44.06*	*24.28*	*26.18*	*27.97*	*22.34*	*21.69*	*20.53*	*19.17*	*18.66*	*19.50*

No. 2 Foundry Pig Iron at Buffalo (at Furnace), per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.43	$12.85	$12.89	$18.75	$34.94	$33.00	$31.00	$40.90	$32.38	$19.44	$26.94	$22.25	$23.00	$21.00	$18.00	$16.45	$17.31
Feb.	17.06	12.94	13.00	18.53	35.25	33.00	31.00	42.00	30.50	18.87	27.56	22.25	22.75	21.00	17.39	16.50	17.00
March	16.70	13.22	12.41	18.72	38.45	33.00	29.94	44.75	29.00	18.30	29.05	21.81	22.12	21.00	17.00	16.39	17.00
April	16.22	13.50	12.80	18.88	42.62	33.00	26.75	45.00	26.15	20.81	29.56	21.37	20.65	21.00	17.50	16.00	17.75
May	15.18	13.41	12.88	18.78	44.95	33.00	26.75	45.00	25.62	22.62	29.40	20.25	19.00	20.75	17.50	16.00	18.06
June	14.32	13.13	12.87	18.65	48.31	33.00	26.75	44.75	23.42	23.05	29.06	19.37	19.00	19.60	17.39	16.00	17.63
July	13.83	13.05	12.70	18.70	52.25	33.00	26.63	45.00	20.87	24.50	26.00	19.00	18.85	19.00	16.88	16.00	17.45
Aug.	13.98	13.25	13.85	18.63	53.00	33.00	27.77	47.75	19.50	30.70	24.95	19.19	18.72	19.00	16.10	16.13	17.63
Sept.	14.09	13.22	14.90	19.00	53.00	33.00	28.25	50.10	20.00	33.94	24.87	19.37	18.75	19.00	16.13	16.63	17.39
Oct.	14.00	12.72	15.63	20.37	33.00	34.00	28.70	47.44	20.37	31.12	23.06	19.05	19.40	19.00	16.88	17.10	17.50
Nov.	13.69	12.44	16.28	27.25	33.00	34.00	34.30	42.56	19.12	27.80	20.87	20.50	21.19	19.00	17.00	17.81	17.39
Dec.	12.87	12.95	18.13	32.75	33.00	34.00	38.25	36.60	19.30	25.50	21.56	22.62	21.50	19.00	17.00	17.60	17.00
Aver.	*14.95*	*13.06*	*14.03*	*20.75*	*41.81*	*33.25*	*29.67*	*44.32*	*23.85*	*24.72*	*26.07*	*20.59*	*20.41*	*19.86*	*17.06*	*16.55*	*17.26*

Southern No. 2 Foundry Pig Iron at Birmingham, Dollars per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$13.56	$10.63	$9.50	$15.00	$23.20	$33.00	$31.00	$38.75	$32.25	$16.20	$23.25	$21.50	$20.00	$22.00	$18.50	$16.00	$16.50
Feb.	13.38	10.56	9.50	15.00	24.63	33.00	31.00	40.00	28.13	15.00	24.38	22.50	20.00	22.00	18.00	16.00	16.50
March	13.06	10.70	9.35	15.00	29.00	33.00	29.44	40.00	25.30	15.00	26.40	22.50	20.00	22.00	18.00	16.00	16.00
April	12.40	10.50	9.44	15.00	34.50	33.00	26.75	40.50	23.50	15.38	27.00	22.30	20.00	22.00	18.00	16.00	15.40
May	11.69	10.50	9.44	15.00	39.00	33.00	26.75	42.00	22.20	17.60	26.85	21.50	20.00	22.00	18.00	15.70	15.00
June	10.81	10.35	9.65	14.50	42.25	33.00	25.25	42.00	21.88	18.38	25.75	20.00	19.60	21.20	18.00	15.88	15.00
July	10.50	10.00	9.75	14.00	47.00	33.00	25.15	42.00	20.25	18.25	25.00	18.00	18.00	21.00	17.44	15.50	14.30
Aug.	10.81	10.00	10.75	13.80	47.00	33.00	27.38	42.00	19.00	20.10	23.70	17.50	18.00	21.00	17.25	15.69	13.38
Sept.	11.00	10.00	11.50	14.38	47.00	33.00	27.95	42.00	19.00	26.00	22.75	17.50	18.50	20.75	17.25	16.25	13.50
Oct.	11.25	10.00	12.13	15.50	33.00	34.00	28.00	42.00	19.00	26.88	20.63	17.50	19.38	20.00	17.25	16.25	13.70
Nov.	10.63	10.00	13.40	20.13	33.00	34.00	30.75	38.00	18.40	23.50	19.60	17.75	21.00	20.00	16.00	16.39	14.00
Dec.	10.70	9.60	14.38	23.00	33.00	33.40	35.20	38.00	17.33	22.88	21.00	19.80	22.00	20.00	16.00	16.50	14.00
Aver.	*11.65*	*10.24*	*10.73*	*15.86*	*36.05*	*33.20*	*28.72*	*40.60*	*22.19*	*19.63*	*23.86*	*19.86*	*19.71*	*21.16*	*17.47*	*16.01*	*14.82*

Bessemer Pig Iron, per Gross Ton, at Valley Furnace

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$19.60	$27.50	$23.00	$22.88	$21.00	$19.50	$17.50	$18.25
Feb.	19.50	28.06	23.50	22.75	21.00	19.00	17.50	18.25
March	19.50	30.25	23.38	22.30	21.00	19.40	17.50	18.38
April	20.63	31.00	22.80	21.13	19.63	19.50	17.50	18.50
May	24.40	30.10	22.13	20.00	19.38	19.20	17.30	19.00
June	25.00	28.50	21.13	19.00	19.00	18.88	17.00	19.00
July	25.00	26.70	20.20	19.00	18.63	18.50	17.00	19.00
Aug.	28.20	26.50	20.00	19.00	18.00	18.40	17.00	19.00
Sept.	33.50	26.50	20.00	19.30	18.25	18.00	17.19	19.00
Oct.	33.40	25.20	20.00	19.63	19.13	18.00	17.55	19.00
Nov.	31.75	23.25	20.38	20.88	19.90	18.00	18.19	19.00
Dec.	28.13	22.88	21.90	21.00	19.88	17.56	18.25	19.00
Aver.	*25.63*	*27.20*	*21.53*	*20.57*	*19.57*	*18.66*	*17.46*	*18.78*

Malleable Pig Iron, per Gross Ton, f.o.b. Valley Furnace

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$19.50	$27.00	$22.39	$22.39	$20.50	$18.50	$17.30	$18.00
Feb.	19.00	27.63	23.00	22.00	20.50	18.50	17.25	18.00
March	19.00	30.50	22.50	21.50	20.50	18.50	17.25	18.25
April	19.50	31.00	22.10	20.63	19.00	18.50	17.25	18.50
May	24.20	30.20	21.00	19.25	18.88	18.50	17.25	19.00
June	24.50	28.13	19.88	18.50	18.05	18.13	17.00	19.00
July	25.13	25.40	19.00	18.50	17.75	18.00	17.00	19.00
Aug.	29.50	24.50	19.13	18.50	17.50	17.60	17.00	19.00
Sept.	33.50	24.50	19.80	18.80	17.63	17.50	17.19	19.00
Oct.	32.70	23.30	19.50	19.13	18.50	17.50	17.55	19.00
Nov.	29.00	20.88	19.75	20.38	19.00	17.50	18.19	19.00
Dec.	26.25	20.00	21.20	20.50	18.75	17.50	18.15	19.00
Aver.	*25.15*	*26.09*	*20.77*	*20.01*	*18.88*	*18.02*	*17.37*	*18.73*

Gray Forge Pig Iron, per Gross Ton, f.o.b. Valley Furnace

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$19.00	$26.50	$22.00	$21.88	$20.00	$18.00	$16.75	$17.00
Feb.	18.81	27.00	22.00	21.50	20.00	18.00	16.75	17.00
March	18.75	30.00	22.00	20.60	20.00	18.00	16.75	17.25
April	20.44	30.50	21.40	19.63	18.50	18.00	16.75	17.50
May	23.30	29.70	20.25	18.63	18.38	18.00	16.70	17.88
June	23.50	26.63	19.13	17.80	17.45	17.63	16.25	18.00
July	23.75	25.00	18.50	18.00	17.20	17.50	16.25	18.00
Aug.	29.45	24.00	18.63	18.00	17.00	17.10	16.25	18.00
Sept.	34.13	24.00	19.30	18.30	17.13	17.00	16.44	18.00
Oct.	31.10	23.30	19.00	18.63	18.00	17.00	16.60	18.00
Nov.	27.63	21.39	19.00	19.88	18.50	16.95	17.13	18.00
Dec.	25.25	21.50	20.70	20.00	18.25	16.75	17.20	18.00
Aver.	*24.59*	*25.79*	*20.16*	*19.39*	*18.39*	*17.33*	*16.65*	*17.72*

Basic Pig Iron, Delivered Eastern Pennsylvania

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$20.18	$27.80	$23.00	$24.25	$23.00	$21.50	$19.50	$19.75
Feb.	19.84	28.19	22.69	23.88	23.00	21.19	19.50	19.88
March	22.61	29.56	21.81	23.55	22.10	20.85	19.50	20.25
April	21.00	30.81	21.50	22.31	21.75	20.75	19.50	20.25
May	24.00	30.60	21.00	21.13	21.75	20.75	19.10	20.25
June	25.00	28.14	21.00	21.50	21.45	20.75	19.00	20.25
July	25.75	26.60	20.20	21.50	21.00	20.75	18.95	20.20
Aug.	27.23	25.00	20.00	20.50	20.95	20.15	18.75	19.75
Sept.	30.83	25.00	20.00	20.70	20.75	20.00	18.88	19.75
Oct.	29.30	24.20	20.00	21.25	20.69	20.00	19.45	19.75
Nov.	27.83	22.88	21.13	22.39	22.60	19.60	19.75	19.75
Dec.	27.31	23.13	23.41	23.00	22.00	19.25	20.05	19.55
Aver.	*25.08*	*26.83*	*21.31*	*22.16*	*21.75*	*20.46*	*19.33*	*19.95*

Standard Low-Phosphorus Pig Iron at Furnace in New York State (Per Gross Ton)

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$30.00	$35.00	$27.10	$25.50	$23.25	$24.50	$23.00	$22.00
Feb.	30.00	35.00	27.00	25.50	23.00	25.00	23.00	22.00
March	30.00	35.00	27.00	25.10	22.50	25.00	23.00	22.00
April	30.00	35.00	25.80	24.75	22.38	25.00	23.00	22.00
May	30.00	33.20	24.75	24.00	22.00	25.00	22.00	22.00
June	30.00	30.50	24.75	23.00	22.00	25.00	22.00	22.00
July	30.00	29.00	24.00	22.00	22.00	25.00	22.00	22.00
Aug.	33.00	29.00	24.00	22.00	22.00	25.00	22.00	22.00
Sept.	38.00	28.50	24.00	22.00	22.00	23.00	22.00	22.00
Oct.	38.00	28.00	23.75	22.00	22.88	23.00	22.00	22.00
Nov.	38.00	27.88	23.88	24.00	24.10	23.00	22.00	22.00
Dec.	35.00	27.50	25.30	24.00	24.00	23.00	22.20	22.00
Aver.	*32.67*	*31.13*	*25.11*	*23.65*	*22.68*	*24.29*	*22.35*	*22.00*

Virginia No. 2X Foundry Pig Iron, Delivered Eastern Pennsylvania (Per Gross Ton)

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$27.84	$32.97	$30.17	$29.67	$28.17	$27.67	$24.54	$25.79
Feb.	27.61	33.17	30.52	29.67	28.17	26.67	24.54	25.79
March	27.24	33.79	30.67	29.67	28.17	26.67	24.54	25.67
April	27.74	34.67	30.67	29.67	28.17	27.17	24.54	25.29
May	28.24	35.07	30.67	29.17	28.17	27.17	24.54	25.29
June	28.24	33.17	30.67	29.17	28.17	27.17	24.54	24.54
July	30.17	32.27	29.87	29.17	28.17	27.17	24.54	24.54
Aug.	30.17	31.42	28.67	29.17	28.17	26.67	24.41	24.54
Sept.	36.17	30.92	28.67	28.77	28.17	25.98	24.54	24.54
Oct.	38.17	30.17	28.67	28.17	28.17	25.79	24.54	24.54
Nov.	37.17	30.17	28.67	28.17	28.17	25.79	24.60	22.79
Dec.	33.92	30.17	29.27	28.17	28.17	25.79	25.29	22.79
Aver.	*31.06*	*32.33*	*29.77*	*29.05*	*28.17*	*26.64*	*24.60*	*24.68*

The IRON AGE Composite Iron and Steel Prices

Composite Pig Iron Price

Average of THE IRON AGE quotations on basic pig iron at Valley furnace and foundry iron at Chicago, Birmingham, Buffalo, Valley and Philadelphia. Quoted in dollars per gross ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.49	$12.76	$12.38	$17.81	$28.88	$33.21	$31.36	$39.08	$31.18	$18.48	$26.78	$22.15	$22.44	$21.79	$19.44	$17.63	$18.43
Feb.	16.31	13.18	12.38	17.76	29.75	33.21	31.36	42.35	28.45	18.14	27.20	22.84	22.50	21.77	19.07	17.73	18.38
March	16.07	13.16	12.34	18.06	32.18	33.21	30.10	42.17	25.18	18.35	30.11	22.81	21.99	21.65	19.03	17.73	18.36
April	15.74	13.13	12.37	18.15	38.56	32.71	27.11	42.93	23.73	20.00	30.83	22.31	20.95	20.96	19.21	17.67	18.52
May	14.98	13.06	12.37	18.08	41.87	32.71	26.91	43.64	22.78	23.35	29.74	21.40	19.85	20.69	19.09	17.45	18.70
June	14.35	12.97	12.45	17.91	47.95	32.71	26.46	44.09	21.73	23.95	28.23	20.27	19.22	20.00	18.92	17.23	18.65
July	13.99	12.92	12.55	17.79	52.11	32.73	26.37	45.44	20.22	23.86	25.96	19.31	18.96	19.51	18.56	17.10	18.48
Aug.	13.93	12.91	13.55	17.63	51.43	32.73	26.83	47.38	18.97	26.69	25.19	19.40	19.01	19.46	18.17	17.11	18.39
Sept.	13.97	12.83	14.28	17.82	46.93	32.73	27.11	47.83	19.89	31.78	25.02	19.46	19.39	19.46	18.03	17.54	18.27
Oct.	13.93	12.67	14.67	19.18	33.21	34.31	27.52	45.05	19.97	30.57	23.30	19.46	19.92	19.69	17.96	17.94	18.33
Nov.	13.39	12.42	15.82	24.36	33.21	34.36	30.34	38.65	19.79	27.82	21.40	19.79	21.16	20.13	17.59	18.46	18.36
Dec.	13.06	12.39	17.34	28.63	33.21	34.26	36.13	34.51	19.11	25.70	21.88	21.60	21.54	19.94	17.55	18.51	18.24
Aver.	*14.68*	*12.87*	*13.54*	*19.43*	*36.11*	*33.24*	*28.97*	*42.76*	*22.58*	*24.06*	*26.30*	*20.90*	*20.58*	*20.42*	*18.55*	*17.68*	*18.43*

Composite Price of Finished Steel

Average of THE IRON AGE quotations on steel bars, beams, tank plates, plain wire, open-hearth rails, black pipe and black sheets. Quoted in cents a pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	1.771	1.451	1.383	2.06	3.384	3.549	3.371	3.158	3.057	2.059	2.469	2.783	2.560	2.447	2.432	2.318	2.391
Feb.	1.766	1.477	1.395	2.203	3.501	3.549	3.371	3.486	2.918	2.007	2.605	2.782	2.546	2.428	2.378	2.361	2.391
March	1.756	1.473	1.413	2.447	3.739	3.549	3.282	3.743	2.764	2.014	2.721	2.746	2.537	2.433	2.367	2.362	2.391
April	1.79	1.446	1.437	2.611	4.110	3.549	3.031	3.842	2.737	2.075	2.814	2.692	2.503	2.439	2.360	2.359	2.412
May	1.727	1.424	1.433	2.75	4.562	3.549	3.021	3.804	2.764	2.113	2.793	2.639	2.460	2.416	2.360	2.350	2.412
June	1.687	1.399	1.444	2.689	5.004	3.549	3.021	3.756	2.643	2.148	2.789	2.610	2.440	2.420	2.369	2.341	2.412
July	1.667	1.40	1.471	2.64	5.334	3.549	3.021	3.885	2.455	2.169	2.783	2.563	2.435	2.431	2.367	2.325	2.412
Aug.	1.624	1.446	1.511	2.682	5.249	3.549	3.021	3.967	2.341	2.292	2.775	2.515	2.413	2.431	2.367	2.348	2.402
Sept.	1.591	1.47	1.559	2.765	5.049	3.549	3.004	3.956	2.248	2.419	2.775	2.487	2.397	2.439	2.356	2.348	2.394
Oct.	1.559	1.446	1.634	2.856	3.470	3.55	3.052	3.81	2.218	2.461	2.775	2.464	2.405	2.449	2.319	2.363	2.371
Nov.	1.505	1.397	1.769	3.021	3.444	3.549	3.084	3.566	2.129	2.445	2.775	2.481	2.433	2.453	2.299	2.367	2.362
Dec.	1.463	1.366	1.941	3.278	3.441	3.461	3.11	3.114	2.107	2.439	2.775	2.540	2.450	2.453	2.310	2.385	2.362
Aver.	*1.663*	*1.434*	*1.534*	*2.671*	*4.188*	*3.542*	*3.115*	*3.675*	*2.532*	*2.220*	*2.738*	*2.609*	*2.465*	*2.439*	*2.357*	*2.352*	*2.393*

Billets and Finished Steel

Bessemer Steel Billets at Pittsburgh, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$28.30	$20.13	$19.25	$32.00	$63.00	$47.50	$43.50	$48.00	$43.50	$28.00	$37.30	$40.00	$37.00	$35.00	$35.00	$33.00	$33.00
Feb.	28.50	21.00	19.50	33.50	65.00	47.50	43.50	55.25	42.25	28.00	39.63	40.00	37.00	35.00	33.00	33.00	33.25
March	28.50	21.00	19.70	42.40	66.25	47.50	42.25	60.00	38.40	28.00	44.38	40.00	36.70	35.00	34.00	33.00	34.00
April	28.50	20.80	20.00	45.00	73.75	47.50	38.50	60.00	37.50	29.50	45.00	40.00	35.50	35.00	33.25	33.00	34.80
May	27.37	20.00	20.00	45.00	86.00	47.50	38.50	60.00	37.00	34.00	44.60	38.50	35.25	35.00	33.00	33.00	36.00
June	26.50	19.50	20.50	43.50	98.75	47.50	38.50	61.00	37.00	35.00	42.63	38.00	35.00	35.00	33.00	32.25	35.25
July	26.60	19.00	21.38	41.00	100.00	47.50	38.50	62.50	32.25	35.00	42.50	38.00	35.00	35.00	33.00	32.00	35.00
Aug.	26.00	20.25	23.13	44.20	86.00	47.50	38.50	61.00	29.60	36.10	42.50	37.75	35.00	35.00	33.00	32.00	35.00
Sept.	24.87	21.00	24.10	45.00	66.25	47.50	38.50	58.74	29.00	39.50	41.88	36.40	35.00	35.00	33.00	32.00	35.00
Oct.	23.30	20.00	24.63	46.25	49.38	47.50	38.50	55.00	29.00	40.00	40.00	35.75	34.25	35.00	33.00	32.80	35.00
Nov.	21.00	19.25	26.50	52.00	47.50	47.50	41.38	49.70	29.00	37.75	40.00	35.50	34.75	35.00	33.00	33.00	35.00
Dec.	20.00	19.00	30.60	57.50	47.50	45.50	46.00	43.50	29.00	36.50	40.00	36.00	35.00	35.00	33.00	33.00	34.60
Aver.	*25.79*	*20.08*	*22.44*	*43.95*	*70.78*	*47.33*	*40.51*	*56.22*	*34.46*	*33.95*	*41.70*	*37.99*	*35.23*	*35.00*	*33.27*	*32.67*	*34.66*

Open-Hearth Steel Billets at Pittsburgh, per Gross Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$28.90	$20.25	$19.25	$33.00	$63.00	$47.50	$43.50	$48.00	$43.50	$28.00	$37.50	$40.00	$38.00	$35.00	$35.00	$33.00	$33.00
Feb.	29.00	21.00	19.50	34.75	65.00	47.50	43.50	55.25	41.00	28.00	39.63	40.00	38.00	35.00	33.00	33.00	33.25
March	29.00	21.00	19.70	42.60	66.25	47.50	42.25	60.00	38.50	28.00	44.39	40.00	36.70	35.00	34.00	33.00	34.00
April	29.00	20.80	20.00	45.00	73.75	47.50	38.50	60.00	37.50	29.50	45.00	40.00	35.50	35.00	33.25	33.00	34.80
May	27.63	20.00	20.00	43.40	86.00	47.50	38.50	60.00	37.00	34.00	45.00	38.50	35.25	35.00	33.00	33.00	36.00
June	26.50	19.40	20.50	41.50	98.75	47.50	38.50	61.00	37.00	35.00	42.63	38.00	35.00	35.00	33.00	32.25	35.25
July	26.60	19.00	21.88	42.75	100.00	47.50	38.50	65.00	32.25	35.00	42.50	38.00	35.00	35.00	33.00	32.00	35.00
Aug.	25.39	20.25	23.50	45.00	82.50	47.50	38.50	61.00	29.60	35.50	42.50	37.75	35.00	35.00	33.00	32.00	35.00
Sept.	24.13	21.00	24.60	45.00	66.25	47.50	38.50	58.75	29.00	39.50	41.88	36.40	35.00	35.00	33.00	32.00	35.00
Oct.	23.30	20.00	25.25	46.25	50.50	47.50	38.50	55.00	29.00	40.00	40.00	35.75	34.25	35.00	33.00	32.80	35.00
Nov.	21.00	19.25	27.25	52.00	47.50	47.50	41.39	49.70	29.00	37.75	40.00	35.50	34.75	35.00	33.00	33.00	35.00
Dec.	20.00	19.00	31.80	57.50	47.50	45.50	46.40	43.50	29.00	36.50	44.00	36.00	35.00	35.00	33.00	33.00	34.60
Aver.	*25.87*	*20.08*	*22.77*	*44.06*	*70.58*	*47.33*	*40.54*	*56.43*	*34.36*	*33.90*	*41.75*	*37.99*	*35.62*	*35.00*	*33.27*	*32.67*	*34.66*

Wire Rods at Pittsburgh

No. 5 Bessemer wire rods, per gross ton. The quotations for November and December, 1917, and all of 1918, are Government prices and apply also to open-hearth rods

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$30.00	$25.50	$25.00	$43.00	$75.00	$57.00	$57.00	$60.00	$57.00	$36.00	$47.00	$51.00	$48.00	$45.00	$45.00	$41.60	$42.00
Feb.	30.00	26.38	25.00	48.00	77.50	57.00	57.00	63.75	54.50	35.75	49.38	51.00	48.00	45.00	43.00	43.00	42.00
March	30.00	26.50	25.00	54.80	81.00	57.00	55.75	70.00	52.00	36.00	50.00	51.00	48.00	45.00	43.00	44.00	42.00
April	30.00	26.00	25.00	60.00	85.00	57.00	52.00	70.00	49.00	38.00	50.25	51.00	47.00	45.00	42.25	44.00	42.00
May	30.00	25.50	25.00	60.00	86.00	57.00	52.00	72.50	48.00	38.00	51.00	48.75	46.00	45.00	42.00	44.00	42.00
June	29.50	24.50	25.00	53.75	92.50	57.00	52.00	75.00	48.00	38.50	51.00	48.00	45.60	45.00	42.00	42.00	42.00
July	28.30	24.50	25.63	53.75	96.25	57.00	52.00	75.00	43.00	40.00	51.00	48.00	45.00	45.00	42.25	42.00	42.00
Aug.	28.00	25.00	27.00	55.00	94.00	57.00	52.00	75.00	41.80	42.40	51.00	46.50	45.00	45.00	43.00	42.00	42.00
Sept.	27.37	26.20	29.40	55.00	88.75	57.00	52.00	75.00	39.50	46.25	51.00	46.00	45.00	45.00	43.00	42.00	42.00
Oct.	26.60	25.88	31.75	55.00	77.25	57.00	52.00	75.00	40.50	45.00	51.00	45.50	45.00	45.00	42.75	42.00	40.00
Nov.	25.87	25.25	36.25	63.00	57.00	57.00	54.50	66.40	40.00	45.00	51.00	45.00	45.00	45.00	41.00	42.00	40.00
Dec.	25.17	25.00	39.50	68.75	57.00	57.00	59.50	57.00	38.00	45.00	51.00	48.00	45.00	45.00	40.00	42.00	40.00
Aver.	*28.40*	*25.52*	*28.29*	*55.84*	*79.77*	*57.00*	*53.98*	*69.55*	*45.94*	*40.49*	*50.39*	*48.31*	*46.05*	*45.00*	*42.44*	*42.55*	*41.50*

Plain Wire, Base, at Pittsburgh, Cents a Pound

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	1.51	1.37	1.55	1.35	1.34	1.98	2.95	3.25	3.25	3.25	3.25	2.25	2.45	2.75	2.60	2.50	2.49	2.40	2.50
Feb.	1.55	1.40	1.55	1.40	1.39	2.10	2.95	3.25	3.25	3.50	3.13	2.20	2.63	2.75	2.60	2.50	2.41	2.48	2.50
March	1.57	1.40	1.56	1.40	1.40	2.25	3.11	3.25	3.19	3.50	3.00	2.25	2.65	2.75	2.60	2.50	2.40	2.50	2.50
April	1.60	1.40	1.60	1.40	1.37	2.25	3.23	3.25	3.00	3.50	3.00	2.25	2.68	2.75	2.50	2.50	2.40	2.50	2.50
May	1.60	1.40	1.60	1.36	1.35	2.45	3.45	3.25	3.00	3.50	3.00	2.25	2.75	2.68	2.50	2.50	2.40	2.50	2.50
June	1.55	1.40	1.60	1.30	1.35	2.45	3.70	3.25	3.00	3.50	2.75	2.25	2.75	2.65	2.49	2.50	2.40	2.50	2.50
July	1.50	1.42	1.58	1.32	1.39	2.45	3.95	3.25	3.00	3.50	2.56	2.25	2.75	2.63	2.50	2.50	2.40	2.42	2.50
Aug.	1.50	1.46	1.48	1.36	1.43	2.53	3.95	3.25	3.00	3.69	2.50	2.29	2.75	2.56	2.50	2.50	2.40	2.40	2.43
Sept.	1.46	1.50	1.47	1.40	1.54	2.55	3.95	3.25	3.00	3.75	2.58	2.39	2.75	2.53	2.50	2.50	2.40	2.40	2.40
Oct.	1.44	1.50	1.41	1.40	1.65	2.60	3.25	3.25	3.17	3.75	2.60	2.45	2.75	2.50	2.50	2.50	2.40	2.40	2.40
Nov.	1.37	1.50	1.39	1.39	1.72	2.80	3.25	3.25	3.29	3.65	2.56	2.45	2.75	2.50	2.50	2.50	2.40	2.40	2.40
Dec.	1.34	1.53	1.35	1.31	1.89	2.95	3.25	3.25	3.21	3.25	2.44	2.45	2.75	2.60	2.50	2.50	2.40	2.48	2.40
Aver.	*1.50*	*1.44*	*1.51*	*1.37*	*1.48*	*2.47*	*3.43*	*3.25*	*3.11*	*3.53*	*2.78*	*2.31*	*2.70*	*2.64*	*2.52*	*2.50*	*2.41*	*2.45*	*2.46*

Wire Nails at Pittsburgh, Dollars a Keg of 100 Lb.

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$1.85	$1.71	$1.57	$1.75	$1.54	$1.54	$2.13	$3.00	$3.50	$3.50	$4.50	$3.25	$2.50	$2.70	$3.00	$2.85	$2.65	$2.64	$2.54	$2.65
Feb.	1.85	1.75	1.60	1.75	1.60	1.57	2.25	3.00	3.50	3.50	4.50	3.21	2.40	2.78	3.00	2.85	2.65	2.56	2.63	2.65
March	1.85	1.79	1.60	1.76	1.60	1.60	2.40	3.20	3.50	3.44	4.00	3.02	2.40	2.83	3.00	2.85	2.65	2.55	2.65	2.65
April	1.85	1.80	1.60	1.80	1.60	1.56	2.40	3.28	3.50	3.25	4.00	3.13	2.40	2.93	3.00	2.80	2.65	2.55	2.65	2.65
May	1.82	1.80	1.60	1.80	1.56	1.55	2.50	3.50	3.50	3.25	4.00	3.05	2.40	3.00	2.93	2.75	2.65	2.50	2.55	2.65
June	1.80	1.75	1.60	1.80	1.50	1.55	2.50	3.75	3.50	3.25	4.00	3.00	2.40	3.00	2.90	2.68	2.65	2.50	2.55	2.65
July	1.75	1.70	1.62	1.70	1.52	1.60	2.50	4.00	3.50	3.25	4.00	2.81	2.40	3.00	2.88	2.65	2.65	2.53	2.55	2.64
Aug.	1.70	1.69	1.66	1.65	1.56	1.61	2.58	4.00	3.50	3.25	4.25	2.75	2.48	3.00	2.81	2.65	2.65	2.55	2.55	2.55
Sept.	1.70	1.65	1.70	1.65	1.60	1.69	2.60	4.00	3.50	3.25	4.25	2.86	2.63	3.00	2.78	2.65	2.65	2.55	2.55	2.50
Oct.	1.70	1.64	1.70	1.63	1.60	1.80	2.63	...	3.50	3.31	4.25	2.90	2.70	3.00	2.75	2.63	2.65	2.54	2.55	2.43
Nov.	1.70	1.55	1.70	1.59	1.50	1.87	2.85	3.50	3.50	3.50	4.05	2.84	2.70	3.00	2.75	2.65	2.65	2.50	2.55	2.40
Dec.	1.70	1.53	1.72	1.55	1.51	2.04	3.00	3.50	3.50	4.12	3.25	2.69	2.70	3.00	2.85	2.65	2.65	2.50	2.63	2.40
Aver.	*1.77*	*1.70*	*1.64*	*1.70*	*1.56*	*1.67*	*2.53*	*3.52*	*3.50*	*3.41*	*4.09*	*2.96*	*2.51*	*2.94*	*2.89*	*2.72*	*2.65*	*2.54*	*2.58*	*2.57*

Steel Rails at Mill, Open-Hearth, Dollars per Gross Ton

The extra $2 a gross ton, which was for many years charged for open-hearth rails, was annulled with the rail price announced Oct. 22, 1921

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$30.00	$30.00	$30.00	$30.00	$40.00	$57.00	$57.00	$47.00	$47.00	$40.00	$43.00	$43.00	$43.00	$43.00	$43.00	$43.00	$43.00
Feb.	30.00	30.00	30.00	30.00	40.00	57.00	57.00	47.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
March	30.00	30.00	30.00	30.00	40.00	57.00	54.50	49.50	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
April	30.00	30.00	30.00	30.00	40.00	57.00	47.00	57.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
May	30.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
June	30.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
July	30.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Aug.	30.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Sept.	30.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Oct.	30.00	30.00	30.00	35.00	....	57.00	47.00	57.00	45.25	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Nov.	30.00	30.00	30.00	38.00	....	57.00	47.00	57.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Dec.	30.00	30.00	30.00	40.00	....	57.00	47.00	53.00	40.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Aver.	*30.00*	*30.00*	*30.00*	*34.00*	*40.00*	*57.00*	*49.29*	*54.38*	*45.69*	*40.75*	*43.00*	*43.00*	*43.00*	*43.00*	*43.00*	*43.00*	*43.00*

Soft Steel Bars at Pittsburgh, Cents a Pound

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan. ..	1.50	1.40	1.15	1.70	1.20	1.10	2.03	3.15	2.90	2.70	2.75	2.35	1.50	2.04	2.40	2.10	2.00	1.98	1.81	1.90
Feb. ..	1.50	1.40	1.12	1.70	1.20	1.10	2.31	3.25	2.90	2.70	3.00	2.15	1.39	2.20	2.40	2.10	2.00	1.90	1.85	1.90
March..	1.45	1.40	1.10	1.85	1.20	1.15	2.65	3.63	2.90	2.61	3.63	2.00	1.39	2.39	2.40	2.10	2.00	1.90	1.85	1.90
April ..	1.45	1.40	1.16	1.84	1.15	1.20	2.88	3.75	2.90	2.35	3.75	2.05	1.50	2.50	2.29	2.05	2.00	1.89	1.85	1.95
May ..	1.45	1.37	1.20	1.70	1.14	1.20	3.00	4.00	2.90	2.35	3.63	2.10	1.58	2.40	2.24	2.00	1.95	1.85	1.85	1.95
June ..	1.45	1.25	1.20	1.60	1.11	1.21	2.75	4.25	2.90	2.35	3.50	2.05	1.70	2.40	2.20	2.00	2.00	1.81	1.85	1.95
July ..	1.45	1.23	1.25	1.50	1.12	1.25	2.63	4.50	2.90	2.35	3.50	1.84	1.70	2.40	2.15	2.00	2.00	1.80	1.85	1.95
Aug. ..	1.40	1.20	1.30	1.40	1.19	1.30	2.56	4.30	2.90	2.35	3.25	1.74	1.88	2.40	2.13	1.95	2.00	1.80	1.90	1.95
Sept. ..	1.40	1.19	1.37	1.40	1.20	1.34	2.60	4.00	2.90	2.35	3.25	1.63	2.00	2.40	2.04	1.92	2.00	1.78	1.90	1.94
Oct.	1.40	1.12	1.45	1.39	1.15	1.44	2.75	2.90	2.90	2.39	3.13	1.55	2.00	2.40	2.00	2.00	2.00	1.75	1.91	1.90
Nov. ..	1.40	1.08	1.55	1.29	1.10	1.62	2.83	2.90	2.90	2.69	2.87	1.50	2.00	2.40	2.03	2.00	2.00	1.77	1.94	1.90
Dec. ..	1.40	1.12	1.66	1.21	1.07	1.84	3.00	2.90	2.80	2.75	2.35	1.50	2.00	2.40	2.10	2.00	2.00	1.80	1.90	1.90
Aver.	*1.44*	*1.26*	*1.29*	*1.55*	*1.15*	*1.31*	*2.67*	*3.63*	*2.89*	*2.50*	*3.22*	*1.87*	*1.72*	*2.36*	*2.20*	*2.02*	*2.00*	*1.84*	*1.87*	*1.92*

Tank Plates at Pittsburgh, Cents a Pound

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan. ..	1.55	1.40	1.15	1.75	1.20	1.10	2.25	4.45	3.25	3.00	2.72	2.65	1.48	2.06	2.50	2.00	1.86	1.90	1.81	1.90
Feb. ..	1.55	1.40	1.11	1.71	1.20	1.10	2.56	4.88	3.25	3.00	3.50	2.33	1.39	2.23	2.45	2.00	1.80	1.86	1.85	1.90
March..	1.55	1.40	1.12	1.70	1.18	1.10	3.10	5.25	3.25	2.91	3.63	2.04	1.39	2.39	2.39	2.00	1.86	1.85	1.85	1.90
April ..	1.55	1.40	1.21	1.68	1.15	1.15	3.56	5.88	3.25	2.65	3.75	2.10	1.48	2.50	2.28	2.00	1.90	1.85	1.85	1.95
May ..	1.51	1.39	1.25	1.60	1.12	1.15	3.75	6.60	3.25	2.65	3.75	2.20	1.56	2.50	2.20	2.00	1.86	1.84	1.85	1.95
June ..	1.48	1.35	1.25	1.45	1.10	1.16	3.63	8.00	3.25	2.65	3.55	1.95	1.63	2.50	2.18	1.92	1.88	1.80	1.85	1.95
July ..	1.41	1.35	1.30	1.45	1.10	1.22	3.44	9.00	3.25	2.65	3.38	1.85	1.70	2.50	2.09	1.90	1.90	1.80	1.85	1.95
Aug. ..	1.40	1.34	1.35	1.44	1.18	1.26	3.70	8.80	3.25	2.65	3.25	1.78	1.88	2.50	1.95	1.85	1.90	1.80	1.90	1.95
Sept. ..	1.40	1.29	1.47	1.40	1.20	1.34	4.00	8.00	3.25	2.53	3.25	1.64	2.13	2.50	1.82	1.80	1.90	1.78	1.90	1.95
Oct. ..	1.40	1.17	1.53	1.36	1.14	1.44	4.00	3.25	3.25	2.61	3.09	1.60	2.11	2.50	1.80	1.80	1.90	1.75	1.90	1.94
Nov. ..	1.40	1.13	1.59	1.26	1.08	1.65	4.15	3.25	3.25	2.65	2.81	1.54	1.99	2.50	1.83	1.86	1.90	1.77	1.90	1.90
Dec. ..	1.40	1.15	1.60	1.20	1.05	2.04	4.25	3.25	3.13	2.65	2.65	1.50	1.95	2.50	1.92	1.90	1.90	1.80	1.90	1.90
Aver.	*1.47*	*1.31*	*1.33*	*1.50*	*1.14*	*1.31*	*3.53*	*5.88*	*3.24*	*2.72*	*3.28*	*1.93*	*1.72*	*2.43*	*2.12*	*1.91*	*1.88*	*1.82*	*1.87*	*1.93*

Structural Shapes at Pittsburgh, Cents a Pound

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan. ..	1.55	1.40	1.15	1.75	1.20	1.10	1.90	3.25	3.00	2.80	2.47	2.45	1.50	2.06	2.50	2.10	1.90	1.98	1.81	1.90
Feb. ..	1.51	1.40	1.11	1.71	1.20	1.10	2.06	3.25	3.00	2.80	2.70	2.26	1.39	2.20	2.50	2.10	1.90	1.90	1.85	1.90
March..	1.50	1.40	1.15	1.70	1.19	1.10	2.40	3.54	3.00	2.71	3.13	2.08	1.39	2.39	2.39	2.10	1.90	1.90	1.85	1.90
April ..	1.50	1.40	1.21	1.68	1.15	1.20	2.55	3.88	3.00	2.45	3.25	2.10	1.50	2.50	2.29	2.05	1.90	1.88	1.85	1.95
May ..	1.50	1.39	1.25	1.50	1.14	1.20	2.60	4.00	3.00	2.45	3.10	2.20	1.56	2.50	2.24	2.00	1.90	1.80	1.85	1.95
June ..	1.48	1.35	1.25	1.45	1.11	1.20	2.53	4.31	3.00	2.45	3.10	2.10	1.63	2.50	2.20	2.00	1.94	1.80	1.85	1.95
July ..	1.41	1.35	1.30	1.45	1.12	1.25	2.50	4.50	3.00	2.45	3.10	1.93	1.70	2.50	2.09	2.00	2.00	1.80	1.85	1.95
Aug. ..	1.40	1.35	1.35	1.45	1.19	1.30	2.52	4.30	3.00	2.45	3.10	1.82	1.88	2.50	2.00	1.95	2.00	1.80	1.90	1.95
Sept. ..	1.40	1.34	1.42	1.41	1.20	1.35	2.64	4.00	3.00	2.45	3.10	1.64	2.00	2.50	2.00	1.90	2.00	1.78	1.90	1.94
Oct. ..	1.40	1.21	1.48	1.37	1.15	1.44	2.75	3.00	3.00	2.45	3.05	1.60	2.00	2.50	1.93	1.90	2.00	1.75	1.90	1.90
Nov. ..	1.40	1.13	1.57	1.29	1.10	1.60	2.86	3.00	3.00	2.45	2.89	1.54	2.00	2.50	2.00	1.90	2.00	1.77	1.90	1.90
Dec. ..	1.40	1.15	1.60	1.25	1.07	1.78	3.25	3.00	2.90	2.45	2.45	1.50	2.00	2.50	2.10	1.90	2.00	1.80	1.90	1.90
Aver.	*1.45*	*1.32*	*1.32*	*1.50*	*1.15*	*1.31*	*2.55*	*3.67*	*2.99*	*2.53*	*2.95*	*1.94*	*1.71*	*2.43*	*2.19*	*1.99*	*1.95*	*1.83*	*1.87*	*1.92*

No. 28 Gage Black Sheets, at Pittsburgh, Cents a Pound

While No. 24 gage was made the base in 1926, this table has been continued at No. 28 gage, to preserve comparisons with past years.

	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	2.50	2.40	2.20	1.90	2.31	1.87	1.80	2.60	4.50	5.00	4.70	4.48	4.35	3.00	3.35	3.83	3.60	3.35	3.16	3.05	3.10
Feb.	2.50	2.40	2.20	1.87	2.35	1.95	1.80	2.60	4.69	5.00	4.70	5.00	4.21	3.00	3.46	3.85	3.50	3.28	3.05	3.15	3.10
March	2.25	2.40	2.20	1.80	2.35	1.95	1.80	2.71	4.94	5.00	4.61	5.50	3.88	3.00	3.71	3.78	3.44	3.25	3.00	3.14	3.10
April	2.20	2.40	2.20	1.86	2.35	1.91	1.80	2.85	5.75	5.00	4.35	5.50	3.88	3.11	4.00	3.71	3.35	3.25	2.99	3.05	3.10
May	2.20	2.40	2.20	1.90	2.30	1.85	1.79	2.89	7.00	5.00	4.35	5.50	4.00	3.15	3.88	3.60	3.20	3.18	3.11	2.96	3.10
June	2.20	2.40	2.00	1.90	2.27	1.81	1.75	2.90	7.88	5.00	4.35	5.50	3.80	3.15	3.85	3.53	3.15	3.10	3.25	2.90	3.10
July	2.20	2.24	2.00	1.95	2.25	1.80	1.75	2.90	8.50	5.00	4.35	6.75	3.31	3.15	3.81	3.46	3.13	3.10	3.25	2.87	3.10
Aug.	2.20	2.21	1.99	2.02	2.21	1.86	1.85	2.90	8.50	5.00	4.35	7.50	2.90	3.23	3.75	3.45	3.15	3.10	3.25	2.90	3.10
Sept.	2.26	2.15	1.91	2.07	2.14	1.95	1.90	2.93	8.50	5.00	4.35	7.38	2.81	3.35	3.75	3.50	3.14	3.15	3.25	2.90	3.10
Oct.	2.30	2.20	1.85	2.21	2.04	1.94	2.03	3.23	...	5.05	4.35	6.69	3.00	3.47	3.75	3.50	3.11	3.23	3.15	3.00	3.02
Nov.	2.30	2.20	1.85	2.25	1.97	1.87	2.25	3.65	5.00	5.00	4.35	5.77	2.86	3.35	3.75	3.50	3.25	3.25	3.03	3.00	3.00
Dec.	2.40	2.19	1.84	2.25	1.89	1.82	2.50	4.31	5.00	4.85	4.35	4.35	3.00	3.35	3.75	3.54	3.33	3.25	3.03	3.08	3.00
Average..	*2.29*	*2.30*	*2.04*	*2.00*	*2.20*	*1.88*	*1.92*	*3.04*	*6.39*	*4.99*	*4.43*	*5.83*	*3.50*	*3.19*	*3.73*	*3.60*	*3.28*	*3.21*	*3.13*	*3.00*	*3.08*

Automobile Body Sheets, Base No. 22 Gage, f.o.b. Pittsburgh, Cents a Pound

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	4.35	4.70	5.35	4.75	4.50	4.18	4.00	4.10
Feb.	4.35	4.78	5.35	4.68	4.43	4.15	4.08	4.10
March ...	4.35	5.00	5.35	4.46	4.40	4.15	4.15	4.10
April	4.40	5.00	5.25	4.40	4.33	4.15	4.04	4.10
May	4.45	5.35	5.10	4.40	4.29	4.15	4.00	4.10
June	4.50	5.35	5.10	4.22	4.20	4.25	4.00	4.10
July	4.60	5.35	5.06	4.15	4.20	4.25	4.00	4.10
Aug.	4.75	5.35	4.75	4.25	4.20	4.25	4.00	4.08
Sept.	4.85	5.35	4.72	4.25	4.25	4.25	4.00	4.00
Oct.	4.85	5.35	4.60	4.29	4.25	4.15	4.00	4.00
Nov.	4.85	5.35	4.60	4.40	4.25	4.12	4.00	4.00
Dec.	4.70	5.35	4.75	4.50	4.25	4.00	4.08	4.00
Aver....	*4.58*	*5.19*	*5.00*	*4.39*	*4.30*	*4.17*	*4.03*	*4.07*

Blue Annealed Sheets, or Light Plates, No. 10 Gage, Cents a Pound at Pittsburgh

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	3.25	2.53	3.00	2.70	2.50	2.25	2.10	2.10
Feb.	2.25	2.64	3.00	2.70	2.50	2.20	2.10	2.10
March ...	2.25	2.95	2.93	2.69	2.50	2.20	2.10	2.10
April	2.36	3.25	2.86	2.53	2.43	2.18	2.08	2.10
May	2.40	3.20	2.80	2.40	2.40	2.22	2.00	2.13
June	2.40	3.00	2.76	2.31	2.32	2.25	2.00	2.20
July	2.40	3.00	2.68	2.30	2.30	2.25	2.00	2.14
Aug.	2.44	3.00	2.63	2.30	2.30	2.25	2.00	2.10
Sept.	2.50	3.00	2.69	2.25	2.30	2.25	2.00	2.10
Oct.	2.60	3.00	2.70	2.26	2.30	2.14	2.00	2.10
Nov.	2.55	3.00	2.70	2.40	2.30	2.10	2.00	2.10
Dec.	2.50	3.00	2.70	2.50	2.30	2.10	2.08	2.20
Aver....	*2.41*	*2.96*	*2.79*	*2.45*	*2.37*	*2.20*	*2.04*	*2.12*

Hot-Rolled and Cold-Rolled Strip Steel

Quoted in Cents a Pound, at Pittsburgh

	HOT-ROLLED STRIP STEEL									COLD-ROLLED STRIP STEEL								
	1921	1922	1923	1924	1925	1926	1927	1928	1929	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.....	3.30	2.00	2.75	3.00	2.25	2.30	2.34	2.01	1.80	6.25	3.50	4.50	5.00	4.00	3.90	2.95	3.00	2.85
Feb.....	3.11	1.84	2.86	3.00	2.35	2.30	2.21	2.08	1.80	6.06	3.50	4.69	4.75	4.00	3.90	2.80	3.00	2.85
March..	2.93	1.81	3.18	2.93	2.40	2.30	2.30	2.10	1.80	5.83	3.50	5.00	4.75	4.00	3.90	2.92	3.00	2.80
April ...	2.76	1.98	3.30	2.75	2.40	2.30	2.30	2.10	1.90	5.54	3.61	5.25	4.75	4.00	3.79	3.00	3.00	2.75
May....	2.53	2.20	3.30	2.75	2.20	2.30	2.30	1.96	1.90	4.98	3.71	5.25	4.50	3.94	3.75	3.00	3.00	2.75
June....	2.50	2.40	3.23	2.50	2.20	2.30	2.30	1.85	1.90	4.88	4.00	5.19	4.50	3.53	3.72	3.19	3.00	2.75
July....	2.46	2.50	3.00	2.50	2.20	2.30	2.30	1.85	1.90	4.25	4.00	5.00	4.30	3.63	3.60	3.25	2.92	2.75
Aug.....	2.23	2.60	3.00	2.35	2.20	2.30	2.30	1.85	1.90	3.96	4.10	5.00	4.13	3.75	3.60	3.25	2.90	2.75
Sept. ...	2.00	2.75	3.00	2.25	2.20	2.30	2.30	1.85	1.90	3.78	4.25	5.00	4.00	3.75	3.50	3.25	2.72	2.75
Oct.	2.00	2.90	3.00	2.25	2.23	2.30	2.19	1.85	1.90	3.75	4.50	5.00	4.00	3.75	3.25	3.00	2.75	2.75
Nov.....	2.00	2.83	3.00	2.25	2.30	2.30	2.19	1.88	1.90	3.75	4.50	4.98	4.00	3.90	3.25	3.00	2.85	2.75
Dec.....	2.00	2.75	2.88	2.25	2.30	2.30	2.03	1.80	1.90	3.75	4.50	4.91	4.00	3.90	3.00	3.00	2.85	2.75
Aver..	*2.49*	*2.38*	*3.04*	*2.57*	*2.27*	*2.30*	*2.26*	*1.93*	*1.88*	*4.73*	*3.97*	*4.98*	*4.39*	*3.85*	*3.60*	*3.05*	*2.92*	*2.77*

Wrought Iron and Steel Pipe Prices

Computed from discounts as per list, with "trimmings," for carload lots; price for base size pipe, ¾ to 8-in.

Steel Pipe, per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$36.10	$35.20	$34.20	$41.39	$64.84	$88.92	$83.36	$80.64	$77.30	$51.87	$61.13	$70.30	$70.30	$70.30	$70.30	$68.60	$70.30
Feb.	36.10	36.09	35.42	42.63	66.95	88.92	83.36	83.36	76.88	51.87	66.50	70.30	70.30	70.30	70.30	68.60	70.30
March	36.10	36.12	36.10	47.51	72.07	88.92	81.06	83.36	76.88	51.87	66.50	70.30	70.30	70.30	70.30	68.60	70.30
April	36.60	35.54	36.10	51.25	81.51	88.92	76.88	83.36	71.63	51.87	68.02	70.30	70.30	70.30	70.30	69.88	70.30
May	37.20	35.20	38.00	53.72	92.62	88.92	76.88	83.36	67.62	51.87	70.30	70.30	70.30	70.30	70.30	70.30	70.30
June	38.00	35.20	38.00	53.72	95.21	88.92	76.88	83.36	67.62	51.87	70.30	70.30	70.30	70.30	70.30	70.30	70.30
July	38.00	35.20	38.00	53.72	105.59	88.92	76.88	83.36	64.63	51.87	70.30	70.30	70.30	70.30	70.30	70.30	70.30
Aug.	36.53	35.20	38.00	53.72	105.59	88.92	76.88	83.36	63.91	54.74	70.30	70.30	70.30	70.30	70.30	70.30	70.30
Sept.	36.10	35.20	38.00	55.21	105.59	88.92	76.88	83.36	60.21	57.43	70.30	70.30	70.30	70.30	70.30	70.30	70.30
Oct.	35.95	35.20	38.00	55.58	105.59	88.92	76.88	83.36	56.50	58.74	70.30	70.30	70.30	70.30	68.54	70.30	70.30
Nov.	35.20	34.23	39.90	56.57	91.70	88.92	76.88	83.36	56.50	61.13	70.30	70.30	70.30	70.30	66.79	70.30	70.30
Dec.	35.20	34.20	39.90	61.01	88.92	88.92	76.88	83.36	53.96	61.13	70.30	70.30	70.30	70.30	66.79	70.30	70.30
Aver.	*36.42*	*35.22*	*37.47*	*52.25*	*81.73*	*88.92*	*78.31*	*83.13*	*66.14*	*54.69*	*68.71*	*70.30*	*70.30*	*70.30*	*69.57*	*69.84*	*70.30*

Wrought Iron Pipe, per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$49.40	$51.30	$51.30	$58.64	$83.36	$122.27	$116.71	$115.60	$135.06	$100.96	$122.56	$131.10	$131.10	$127.82	$127.82	$127.82	$118.56
Feb.	49.40	51.30	51.30	62.16	85.48	122.27	116.71	119.49	136.16	100.96	127.82	131.10	131.10	127.82	127.82	127.82	118.56
March	49.40	51.30	51.30	66.03	90.65	122.27	114.41	119.49	136.16	100.96	127.82	131.10	127.82	127.82	127.82	127.82	118.56
April	50.00	51.30	51.30	69.78	101.89	122.27	110.22	119.49	125.66	100.96	129.02	131.10	127.82	127.82	127.82	127.82	118.56
May	50.48	51.30	53.20	72.25	113.00	122.27	110.22	119.49	117.63	100.96	131.10	131.10	127.82	127.82	127.82	127.82	118.56
June	51.30	51.30	53.20	72.25	114.85	122.27	110.22	119.49	117.63	100.96	131.10	131.10	127.82	127.82	127.82	127.82	118.56
July	51.30	51.30	53.20	72.25	122.27	122.27	110.22	119.49	111.65	100.96	131.10	131.10	127.82	127.82	127.82	127.82	118.56
Aug.	51.30	51.30	53.20	72.25	122.27	122.27	110.22	119.49	110.22	105.74	131.10	131.10	127.82	127.82	127.82	127.82	118.56
Sept.	51.30	51.30	53.20	73.73	122.27	122.27	110.22	119.49	105.59	116.33	131.10	131.10	127.82	127.82	127.82	127.82	118.56
Oct.	51.30	51.30	53.20	74.10	122.27	122.27	110.22	119.49	100.96	120.41	131.10	131.10	127.82	127.82	127.82	127.82	118.56
Nov.	51.30	51.30	55.10	75.07	122.27	122.27	110.22	119.49	100.96	120.41	131.10	131.10	127.82	127.82	127.82	127.82	118.56
Dec.	51.30	51.30	55.10	79.50	122.27	122.27	110.22	119.49	100.96	120.41	131.10	131.10	127.82	127.82	127.82	127.82	118.56
Aver.	*50.65*	*51.30*	*52.88*	*70.67*	*110.24*	*122.27*	*111.65*	*119.16*	*116.55*	*107.50*	*129.67*	*131.10*	*128.37*	*127.82*	*127.82*	*127.82*	*118.56*

Cast Iron Pipe Prices, 1913 to 1928

At New York, 6-In. per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$25.00	$22.00	$20.00	$29.00	$41.50	$55.35	$65.70	$66.30	$63.30	$47.30	$54.90	$61.60	$54.60	$50.60	$48.60	$37.25	$39.60
Feb.	24.75	22.00	20.00	29.33	41.50	55.35	62.70	70.30	63.30	47.30	56.50	61.60	54.60	50.60	48.60	37.25	39.35
March	23.87	22.00	20.00	29.75	43.10	55.35	62.70	71.30	63.30	47.68	57.75	61.60	53.00	50.60	47.20	37.25	38.60
April	23.50	22.00	21.60	30.50	50.88	55.35	57.70	73.90	63.30	48.80	58.50	61.60	52.60	50.60	47.35	36.25	37.40
May	23.00	20.88	22.00	30.50	55.50	56.60	54.45	76.30	62.05	49.60	58.50	61.60	50.85	50.60	45.80	37.60	35.85
June	23.00	20.50	22.25	30.50	60.75	61.44	52.03	76.30	54.30	50.80	61.35	61.60	50.60	50.60	44.42	37.60	35.10
July	23.00	20.50	22.50	30.50	65.50	61.75	50.46	76.30	52.30	53.50	62.30	60.60	50.60	50.60	42.75	37.60	33.20
Aug.	23.00	20.50	23.25	30.50	65.50	61.75	52.33	76.53	46.05	54.10	62.62	59.60	50.60	50.60	39.65	36.60	33.60
Sept.	23.00	20.40	24.37	30.83	65.50	61.75	54.30	77.22	46.30	54.50	63.60	56.60	50.60	49.85	37.25	35.60	33.60
Oct.	23.00	20.00	25.25	31.50	61.00	67.70	55.30	77.22	47.30	54.50	63.60	56.35	50.60	49.60	36.50	35.60	34.60
Nov.	23.00	20.00	26.50	35.50	56.50	67.70	58.30	77.22	47.30	54.50	63.60*	55.60	50.60	49.60	36.25	37.32	34.60
Dec.	22.33	20.00	27.60	41.00	56.50	67.70	61.30	68.87	47.30	54.75	63.60*	55.20	50.60	49.10	37.00	39.40	34.60
Aver.	*23.37*	*20.90*	*22.94*	*31.62*	*55.31*	*60.65*	*57.27*	*73.98*	*54.68*	*51.44*	*60.57*	*59.46*	*51.65*	*50.25*	*42.61*	*37.11*	*35.84*

*Concession of $2 to $3 per ton from this price to consumers willing to accept winter delivery.

Cast Iron Pipe, Delivered Chicago, 6-In. and Larger, per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$29.00	$25.00	$23.50	$29.00	$41.50	$54.30	$64.30	$67.55	$64.10	$42.50	$51.80	$56.20	$48.70	$49.20	$44.33	$35.00	$43.33
Feb.	29.00	25.00	23.50	29.50	41.75	54.30	61.80	71.30	64.10	41.60	53.20	56.20	49.95	49.20	43.70	35.83	44.45
March	27.83	24.20	23.50	29.50	43.00	54.30	60.55	72.80	64.10	42.10	54.20	56.20	47.60	49.20	44.20	35.70	44.70
April	28.10	24.00	23.50	30.50	53.00	54.30	56.80	74.80	64.10	42.85	57.20	56.20	46.70	49.20	43.95	36.20	44.20
May	26.50	24.00	23.50	30.50	55.50	55.81	54.30	76.80	60.10	44.60	60.20	55.20	47.07	49.20	43.20	37.80	44.20
June	26.50	24.00	23.70	30.50	60.75	60.83	51.80	76.80	52.85	46.10	60.20	54.70	47.70	48.90	42.70	40.20	45.20
July	26.20	24.00	24.00	30.50	65.50	62.05	52.60	76.80	48.85	45.57	60.20	54.80	48.20	47.95	41.58	40.80	45.20
Aug.	26.00	24.00	24.00	30.50	65.50	61.80	55.30	78.18	43.20	46.40	60.20	53.45	49.20	48.30	37.40	42.20	45.20
Sept.	26.00	24.00	24.70	31.00	65.50	61.80	55.80	82.10	42.60	47.45	59.95	51.80	49.20	47.58	34.58	42.20	45.20
Oct.	26.00	24.00	25.75	31.50	53.50	66.80	59.00	83.10	42.60	51.20	57.40	49.70	49.20	47.20	34.20	43.00	43.70
Nov.	25.63	24.00	27.00	36.25	54.25	66.80	59.80	83.10	42.90	51.20	55.45	48.20	50.20	47.20	34.50	45.20	43.70
Dec.	25.00	23.50	27.77	41.00	55.21	66.80	64.40	68.60	43.10	51.20	55.20	47.60	50.20	46.70	35.08	43.10	43.70
Aver.	*26.81*	*24.14*	*24.54*	*31.69*	*54.58*	*59.99*	*58.04*	*76.00*	*52.72*	*46.06*	*57.10*	*53.35*	*48.66*	*48.32*	*39.95*	*39.77*	*44.39*

Southern Ohio No. 2 Foundry Iron, per Gross Ton, at Cincinnati

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$22.15	$29.78	$25.18	$24.27	$23.27	$21.89	$20.89	$20.39
Feb.	22.03	30.28	26.03	24.27	22.92	21.39	20.89	20.39
March	21.38	32.68	25.78	23.87	22.89	21.26	20.89	20.39
April	22.78	33.14	25.39	23.15	21.99	21.39	20.89	20.39
May	25.28	32.23	24.39	21.77	21.76	21.19	20.89	20.09
June	25.53	30.53	22.53	21.27	20.89	20.89	20.39	19.89
July	26.40	28.71	21.58	21.27	21.29	20.76	19.89	19.89
Aug.	30.18	28.08	21.78	21.77	21.39	20.39	19.89	19.89
Sept.	34.28	27.03	22.15	21.77	21.39	20.89	18.89	19.89
Oct.	34.53	26.93	22.28	21.90	21.39	20.89	19.19	19.89
Nov.	31.83	24.78	22.90	23.27	21.89	20.89	20.27	19.89
Dec.	29.28	24.78	23.88	23.27	21.89	20.89	20.39	19.89
Aver.	*27.14*	*28.75*	*23.66*	*22.65*	*21.91*	*21.06*	*20.28*	*20.07*

Eight Years of Finished Iron and Steel, Chicago and Pittsburgh

Sheets, Bars and Beams at Chicago—Rivets, Cotton Ties and Cold-Finished Bars at Pittsburgh

Black Sheets, No. 28 Gage, at Chicago, Cents a Pound

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	3.38	3.69	4.17	3.75	3.50	3.45	3.28	3.25
Feb.	3.38	3.69	4.19	3.75	3.50	3.23	3.30	3.25
March	3.38	3.90	4.14	3.75	3.50	3.25	3.30	3.35
April	3.46	4.25	4.03	3.65	3.48	3.25	3.26	3.35
May	3.53	4.19	3.99	3.48	3.40	3.37	3.12	3.35
June	3.53	4.19	3.99	3.32	3.31	3.40	3.08	3.35
July	3.49	4.19	3.84	3.35	3.30	3.40	3.05	3.35
Aug.	3.57	4.19	3.84	3.35	3.30	3.40	3.05	3.30
Sept.	3.69	4.12	3.93	3.35	3.33	3.40	3.05	3.25
Oct.	3.69	4.09	3.65	3.31	3.43	3.30	3.11	3.25
Nov.	3.69	4.09	3.68	3.43	3.50	3.19	3.15	3.13
Dec.	3.69	4.09	3.75	3.50	3.50	3.15	3.18	3.05
Aver.	*3.54*	*4.06*	*3.93*	*3.50*	*3.42*	*3.32*	*3.16*	*3.27*

Galvanized Steel Sheets, No. 28 Gage, at Chicago, Cents a Pound

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	4.38	4.69	5.34	4.90	4.75	4.53	4.38	4.25
Feb.	4.38	4.69	5.34	4.90	4.75	4.40	4.40	4.25
March	4.38	5.02	5.29	4.88	4.75	4.40	4.40	4.35
April	4.46	5.28	5.21	4.75	4.75	4.40	4.36	4.35
May	4.53	5.34	5.12	4.55	4.68	4.48	4.25	4.35
June	4.53	5.34	5.14	4.39	4.55	4.50	4.20	4.35
July	4.49	5.34	5.00	4.38	4.45	4.50	4.15	4.35
Aug.	4.67	5.34	4.94	4.39	4.45	4.50	4.15	4.20
Sept.	4.69	5.34	5.00	4.40	4.44	4.50	4.15	4.15
Oct.	4.69	5.34	4.75	4.41	4.54	4.45	4.15	4.15
Nov.	4.69	5.22	4.79	4.68	4.60	4.35	4.15	4.10
Dec.	4.69	5.24	4.90	4.75	4.60	4.20	4.18	4.00
Aver.	*4.54*	*5.18*	*5.07*	*4.62*	*4.61*	*4.43*	*4.24*	*4.24*

Blue Annealed Sheets, Nos. 9 and 10 Gage, at Chicago, Cents a Pound

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	2.63	2.84	3.34	2.85	2.65	2.56	2.24	2.25
Feb.	2.63	2.84	3.34	2.85	2.65	2.36	2.25	2.25
March	2.63	3.03	3.29	2.83	2.65	2.39	2.25	2.35
April	2.71	3.32	3.21	2.75	2.65	2.40	2.24	2.35
May	2.78	3.34	3.14	2.55	2.65	2.40	2.20	2.35
June	2.78	3.34	3.14	2.44	2.49	2.40	2.18	2.50
July	2.74	3.34	3.07	2.48	2.45	2.40	2.15	2.50
Aug.	2.78	3.34	3.04	2.45	2.45	2.40	2.15	2.35
Sept.	2.84	3.34	3.10	2.45	2.45	2.40	2.15	2.35
Oct.	2.84	3.34	2.85	2.45	2.53	2.38	2.15	2.35
Nov.	2.84	3.34	2.85	2.58	2.55	2.27	2.15	2.35
Dec.	2.84	3.34	2.85	2.65	2.55	2.15	2.18	2.30
Aver.	*2.75*	*3.23*	*3.10*	*2.61*	*2.56*	*2.38*	*2.19*	*2.35*

Rail Steel Bars at Chicago Mill, Cents a Pound

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	1.56	2.00	2.30	2.03	2.00	1.90	1.80	1.90
Feb.	1.50	2.10	2.30	2.10	2.00	1.90	1.80	1.95
March	1.50	2.28	2.30	2.10	2.00	1.90	1.80	1.95
April	1.55	2.33	2.30	2.10	2.00	1.90	1.83	1.95
May	1.60	2.30	2.20	2.10	1.98	1.90	1.85	1.95
June	1.63	2.28	2.15	2.02	1.96	1.90	1.86	1.95
July	1.70	2.30	2.10	2.00	1.98	1.90	1.85	1.95
Aug.	1.89	2.30	2.05	2.00	2.00	1.90	1.85	1.95
Sept.	2.00	2.30	2.00	2.00	2.00	1.90	1.85	1.95
Oct.	2.00	2.30	2.00	2.00	2.00	1.83	1.95	1.95
Nov.	2.00	2.30	2.00	2.00	1.96	1.80	1.95	1.94
Dec.	2.00	2.30	2.00	2.00	1.90	1.80	1.95	1.90
Aver.	*1.75*	*2.25*	*2.14*	*2.04*	*1.98*	*1.88*	*1.86*	*1.94*

Cotton Tie Prices for Twenty-Four Years

(Per Bundle of 45-Lb., f.o.b. Pittsburgh)

1905	$0.85	1914	$0.65	1922	$1.10
1906	0.85	1915	0.85	1923	1.60
1907	0.95	1916	1.35	1924	*1.40
1908	0.85	1917	2.10	1925	†1.25
1909	0.70	1918	2.10	1926	‡1.20
1910	0.75	1919	1.70	1927	**1.20
1911	0.75	1920	2.00	1928	(a)1.27
1912	0.70	1921	1.30	1929	*1.05
1913	0.80				

*F.o.b. Atlantic and Gulf ports.
†F.o.b. Gulf ports; 1.28, f.o.b. Atlantic ports.
‡F.o.b. Gulf ports; $1.22, f.o.b. Atlantic ports.
**F.o.b. Gulf ports; $1.21, f.o.b. Atlantic ports.
(a) In lots of 2000 bundles, $1.25; larger lots, $1.23.

Common Bar Iron at Chicago, Cents a Pound

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	1.60	2.35	2.40	2.00	2.00	2.00	1.90	2.00
Feb.	1.58	2.46	2.40	2.03	2.00	2.00	1.93	2.00
March	1.58	2.53	2.40	2.10	2.00	2.00	2.00	2.04
April	1.63	2.60	2.35	2.10	2.00	2.00	2.00	2.05
May	1.67	2.60	2.28	2.08	2.00	2.00	2.00	2.05
June	1.74	2.55	2.23	2.01	2.00	2.00	2.00	2.05
July	1.85	2.50	2.20	1.96	2.00	2.00	2.00	2.05
Aug.	2.11	2.40	2.18	1.90	2.00	2.00	2.00	2.05
Sept.	2.25	2.39	2.14	1.90	2.00	1.98	2.00	2.05
Oct.	2.50	2.38	2.10	1.90	2.00	1.88	2.00	2.04
Nov.	2.50	2.40	2.08	1.94	2.00	1.88	2.00	2.00
Dec.	2.35	2.40	2.01	2.00	2.00	1.90	2.00	2.00
Aver.	*1.95*	*2.47*	*2.23*	*1.99*	*2.00*	*1.97*	*1.99*	*2.03*

Soft Steel Bars at Chicago, Cents a Pound

	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	2.73	1.60	2.08	2.50	2.13	2.10	2.10	1.91	2.00
Feb.	2.57	1.53	2.21	2.50	2.20	2.10	2.03	1.95	2.01
March	2.40	1.55	2.45	2.50	2.20	2.10	2.00	1.98	2.05
April	2.43	1.60	2.84	2.38	2.15	2.10	2.00	2.00	2.05
May	2.48	1.66	2.74	2.30	2.10	2.10	2.00	2.00	2.05
June	2.37	1.75	2.60	2.25	2.10	2.10	2.00	2.00	2.05
July	2.21	1.75	2.60	2.19	2.10	2.10	2.00	2.00	2.05
Aug.	1.96	2.05	2.60	2.13	2.10	2.10	1.98	2.00	2.05
Sept.	1.78	2.10	2.50	2.02	2.10	2.10	1.90	2.00	2.05
Oct.	1.75	2.10	2.50	2.00	2.10	2.10	1.85	2.00	2.03
Nov.	1.67	2.10	2.50	2.05	2.10	2.10	1.87	2.00	2.00
Dec.	1.60	2.10	2.50	2.10	2.10	2.10	1.90	2.00	2.00
Aver.	*2.16*	*1.83*	*2.51*	*2.24*	*2.12*	*2.10*	*1.97*	*1.99*	*2.03*

Structural Steel Beams at Chicago, Cents a Pound

	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	2.83	1.60	2.18	2.60	2.23	2.10	2.10	1.91	2.00
Feb.	2.67	1.53	2.31	2.60	2.30	2.10	2.03	1.95	2.01
March	2.50	1.55	2.52	2.60	2.30	2.10	2.00	1.98	2.05
April	2.53	1.60	2.84	2.50	2.25	2.10	2.00	2.00	2.05
May	2.58	1.66	2.84	2.45	2.20	2.10	2.00	2.00	2.05
June	2.48	1.75	2.70	2.39	2.18	2.10	2.00	2.00	2.05
July	2.28	1.75	2.70	2.27	2.10	2.10	2.00	2.00	2.05
Aug.	1.99	2.05	2.70	2.20	2.10	2.10	1.94	2.00	2.05
Sept.	1.79	2.20	2.60	2.06	2.10	2.10	1.90	2.00	2.05
Oct.	1.75	2.20	2.60	2.00	2.10	2.10	1.85	2.00	2.03
Nov.	1.69	2.20	2.60	2.15	2.10	2.10	1.87	2.00	2.00
Dec.	1.63	2.20	2.60	2.20	2.10	2.10	1.90	2.00	2.00
Aver.	*2.23*	*1.86*	*2.59*	*2.33*	*2.17*	*2.10*	*1.97*	*1.99*	*2.03*

Cold-Finished Steel Bars, Base per 100 Pounds, f.o.b. Pittsburgh

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$1.94	$2.53	$3.00	$2.80	$2.50	$2.30	$2.20	$2.20
Feb.	1.90	2.73	2.95	2.80	2.50	2.30	2.20	2.20
March	1.80	2.85	2.98	2.72	2.50	2.38	2.20	2.20
April	1.85	3.00	3.00	2.70	2.50	2.40	2.20	2.30
May	1.94	3.25	2.90	2.70	2.50	2.40	2.20	2.30
June	2.03	3.25	2.90	2.60	2.50	2.33	2.20	2.30
July	2.10	3.25	2.84	2.60	2.50	2.20	2.10	2.30
Aug.	2.23	3.25	2.80	2.50	2.50	2.20	2.10	2.30
Sept.	2.50	3.25	2.74	2.46	2.50	2.15	2.10	2.30
Oct.	2.50	3.10	2.70	2.40	2.40	2.10	2.16	2.30
Nov.	2.50	2.95	2.70	2.48	2.30	2.10	2.20	2.30
Dec.	2.50	3.00	2.78	2.50	2.30	2.10	2.20	2.30
Aver.	*2.15*	*3.03*	*2.86*	*2.61*	*2.46*	*2.25*	*2.17*	*2.28*

Large Structural Rivets, Base per 100 Pounds, f.o.b. Pittsburgh

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$2.25	$3.00	$2.90	$2.60	$2.60	$2.34	$2.75	$2.90
Feb.	2.18	3.00	2.75	2.60	2.53	2.30	2.75	2.90
March	2.00	3.25	2.75	2.60	2.50	2.30	2.90	2.90
April	2.10	3.25	2.65	2.58	2.50	2.75	2.90	3.06
May	2.24	3.25	2.65	2.45	2.50	2.75	2.90	3.10
June	2.36	3.25	2.61	2.40	2.50	2.75	2.90	3.10
July	2.46	3.13	2.60	2.40	2.50	2.75	2.90	3.10
Aug.	2.65	3.00	2.55	2.40	2.50	2.75	2.90	3.10
Sept.	3.00	2.95	2.60	2.40	2.48	2.75	2.90	3.10
Oct.	3.12	2.75	2.58	2.40	2.45	2.75	2.90	3.10
Nov.	3.10	2.68	2.60	2.60	2.45	3.00	2.90	3.10
Dec.	3.00	2.90	2.60	2.60	2.40	2.75	2.90	3.10
Aver.	*2.55*	*3.02*	*2.65*	*2.50*	*2.50*	*2.66*	*2.88*	*3.05*

Monthly Averages of Ferroalloy Quotations

Ferromanganese (80 *Per Cent*) *Prices in Dollars per Gross Ton, at Seaboard*

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$68.00	$44.40	$68.00	$150.00	$175.00	$250.00	$255.00	$146.00	$112.50	$58.35	$105.00	$108.70	$112.50	$115.00	$100.00	$100.00	$105.00
Feb.	65.00	39.25	69.75	207.50	231.25	250.00	215.00	172.50	100.00	60.42	107.50	107.50	115.00	115.00	100.00	100.00	105.00
March	65.00	38.50	100.00	349.60	290.00	250.00	175.00	216.25	96.00	62.50	113.75	107.50	115.00	97.60	100.00	100.00	105.00
April	61.00	38.00	100.00	406.25	362.50	290.00	150.00	240.00	90.00	64.37	120.00	107.50	115.00	88.00	100.00	100.00	105.00
May	61.00	38.00	100.00	387.50	420.50	290.00	138.40	250.00	85.00	66.87	128.00	107.50	115.00	88.00	94.00	103.00	105.00
June	61.00	38.00	100.00	270.00	443.75	290.00	121.00	225.00	80.00	67.50	128.75	107.50	115.00	88.00	90.00	105.00	105.00
July	59.00	37.20	109.00	175.00	406.25	290.00	111.00	225.00	70.60	67.50	*119.50	106.50	115.00	88.00	90.00	105.00	105.00
Aug.	56.38	108.33	127.25	172.00	400.00	290.00	101.25	198.75	70.00	67.50	117.50	95.75	115.00	88.00	90.00	105.00	105.00
Sept.	56.00	90.00	117.00	169.75	387.50	285.00	98.75	170.00	65.80	75.63	*111.25	90.00	115.00	88.00	90.00	105.00	105.00
Oct.	50.10	70.40	105.00	162.25	310.00	285.00	105.00	170.00	63.00	100.00	*110.00	90.00	115.00	88.00	90.00	105.00	105.00
Nov.	50.00	68.00	105.00	160.80	256.00	285.00	112.50	170.00	61.50	100.00	*108.75	98.75	115.00	96.60	90.00	105.00	105.00
Dec.	47.00	72.20	106.00	169.75	243.75	275.00	122.50	135.00	60.00	100.00	*108.25	107.00	115.00	100.00	100.00	105.00	105.00
Aver.	*58.29*	*56.86*	*105.83*	*231.70*	*327.21*	*277.50*	*142.12*	*193.21*	*79.53*	*74.22*	*114.85*	*102.85*	*114.79*	*95.02*	*94.50*	*103.17*	*105.00*

*Price at furnace, where lower than price at seaboard.

Spiegeleisen (19 *to* 21 *Per Cent*), *Dollars per Gross Ton at Furnace*

	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$25.00	$25.00	$30.38	$60.00	$60.00	$66.00	$51.40	$45.00	$26.00	$34.40	$38.00	$33.00	$32.00	$37.00	$30.80	$31.00
Feb.	25.00	25.00	36.25	68.75	61.25	60.75	58.75	40.00	38.00	35.50	38.00	33.00	32.00	37.00	31.00	31.00
March	25.00	25.00	57.00	75.00	71.25	47.00	60.00	35.00	29.40	40.00	38.00	33.00	32.00	37.00	31.00	31.00
April	25.00	25.00	65.00	75.00	80.75	45.00	67.60	34.00	32.25	45.00	36.80	33.00	32.00	37.00	31.00	31.00
May	25.00	25.00	65.00	81.00	84.00	37.40	75.00	32.00	35.00	52.50	36.00	33.00	32.00	36.25	31.00	31.00
June	25.00	25.00	61.00	82.50	89.00	31.25	75.00	32.00	36.00	48.50	35.00	32.80	32.00	35.50	31.00	31.00
July	25.00	25.00	52.50	85.00	89.00	35.00	75.00	27.00	36.00	44.00	34.20	32.00	32.00	33.50	31.00	31.00
Aug.	25.00	25.00	45.00	85.00	89.00	35.00	80.00	26.00	37.80	46.75	32.50	32.00	32.00	33.00	32.50	31.00
Sept.	25.00	26.60	45.00	82.50	83.75	35.00	82.00	26.00	38.25	43.75	31.40	31.80	32.00	33.00	33.00	31.00
Oct.	25.00	29.25	42.75	76.25	82.00	35.00	81.88	26.00	38.00	43.75	30.75	31.25	32.00	30.75	33.00	31.00
Nov.	25.00	29.25	45.40	66.00	80.25	37.00	75.62	26.00	37.50	41.25	30.25	32.00	37.40	30.00	30.00	31.00
Dec.	25.00	29.25	55.00	60.00	74.38	40.00	59.10	26.00	37.50	39.00	32.00	32.00	36.50	30.00	31.00	31.00
Aver.	*25.00*	*26.20*	*50.02*	*74.75*	*78.72*	*42.03*	*70.11*	*31.25*	*34.31*	*42.87*	*34.41*	*32.40*	*32.83*	*34.17*	*31.36*	*31.00*

50 Per Cent Ferrosilicon (Per Gross Ton, Delivered East of Mississippi)

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$54.00	$82.50	$75.00	$82.50	$85.00	$85.00	$83.50	$83.50
Feb.	55.00	83.75	75.00	82.50	85.00	85.00	83.50	83.50
March	55.00	90.00	75.00	82.50	85.00	85.00	83.50	83.50
April	55.00	92.50	75.00	82.50	85.00	85.00	83.50	83.50
May	55.00	94.50	75.00	82.50	85.00	85.00	83.50	83.50
June	55.00	90.00	75.00	82.50	85.00	85.00	83.50	83.50
July	55.00	82.50	71.00	82.50	85.00	85.00	83.50	83.50
Aug.	55.00	82.50	71.25	82.50	85.00	85.00	83.50	83.50
Sept.	55.00	82.50	72.00	82.50	85.00	85.00	83.50	83.50
Oct.	67.00	81.00	71.00	82.50	85.00	85.00	83.50	83.50
Nov.	75.00	80.63	70.00	82.50	85.00	85.00	83.50	83.50
Dec.	82.50	76.25	75.00	82.50	85.00	83.50	83.50	83.50
Aver.	*59.88*	*84.89*	*73.35*	*82.50*	*85.00*	*84.88*	*83.50*	*83.50*

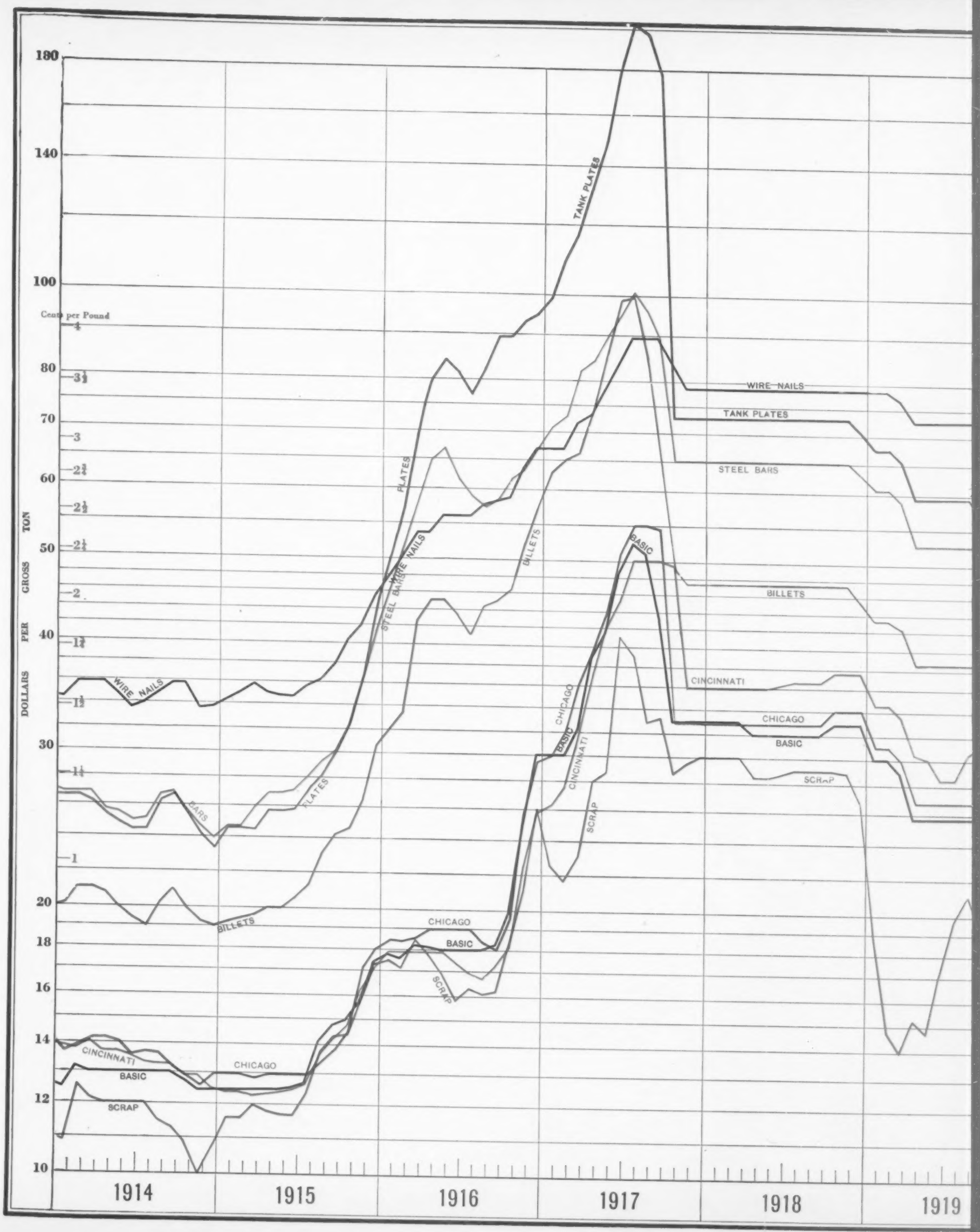
Connellsville Coke Prices for Nineteen Years

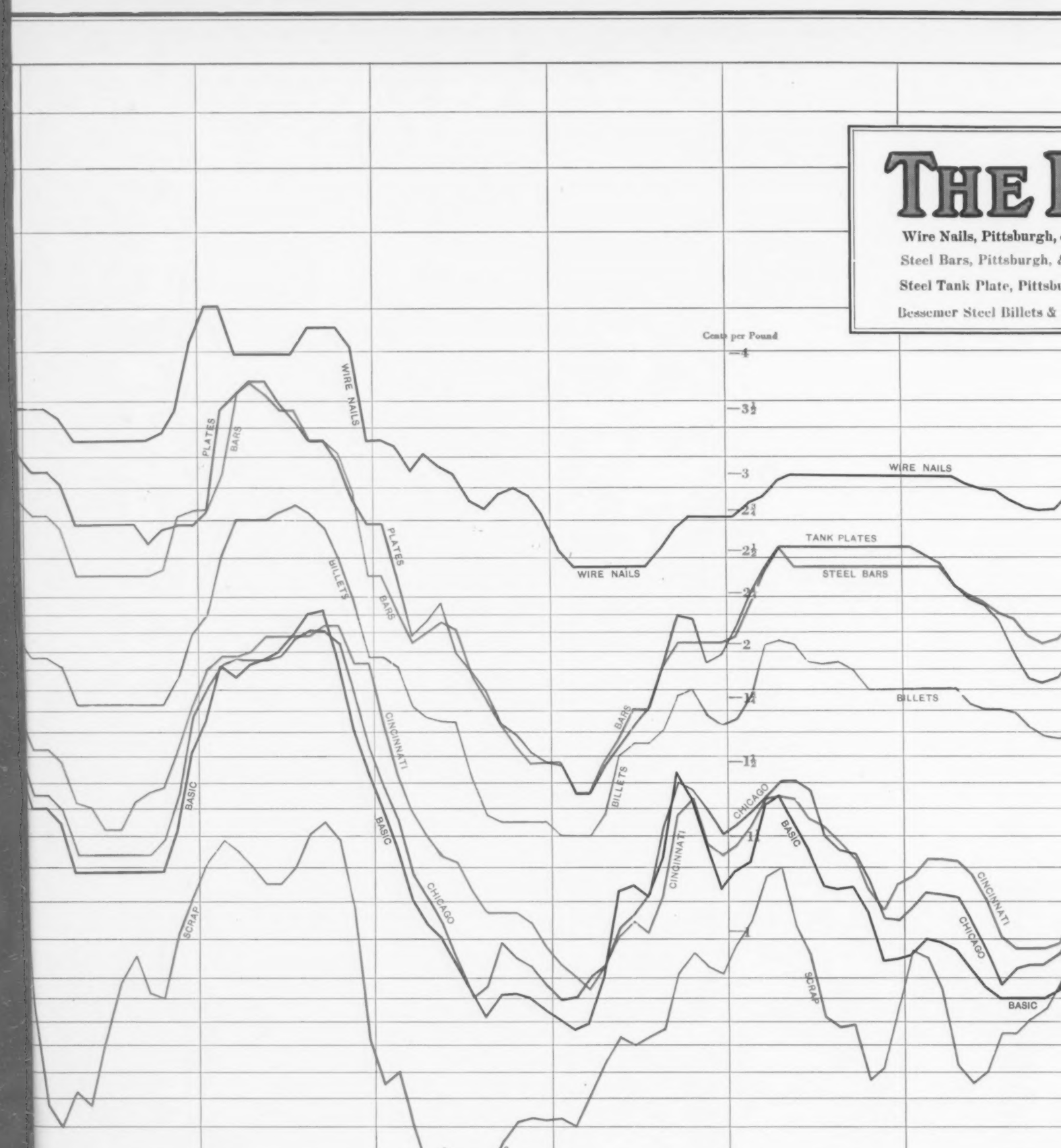
Prompt Connellsville Furnace Coke, per Net Ton at Oven

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$1.40	$1.82	$3.88	$1.85	$1.50	$2.94	$9.50	$6.00	$5.65	$6.00	$5.06	$2.75	$8.05	$3.94	$3.94	$7.19	$3.50	$2.70	$2.75
Feb.	1.45	1.78	2.52	1.85	1.50	3.38	9.62	6.00	4.44	6.00	4.50	3.04	7.13	4.08	3.63	7.31	3.38	2.68	2.90
March	1.55	2.12	2.40	1.90	1.50	3.47	9.60	6.00	4.06	6.00	4.35	3.25	7.25	4.08	3.35	3.05	3.35	2.60	2.98
April	1.59	2.39	2.15	1.86	1.50	2.41	7.38	6.00	3.65	9.60	3.50	4.48	6.31	3.75	3.04	3.00	3.20	2.60	2.78
May	1.50	2.28	2.13	1.77	1.50	2.30	7.80	6.00	3.69	12.00	3.25	6.00	5.15	3.25	3.00	2.91	2.94	2.60	2.75
June	1.42	2.02	2.11	1.75	1.56	2.49	11.25	6.00	4.00	15.00	3.00	6.75	4.75	3.19	2.77	2.83	2.93	2.60	2.75
July	1.44	2.21	2.45	1.75	1.64	2.75	12.75	6.00	4.07	17.20	2.81	10.75	4.55	3.00	2.83	2.84	3.00	2.63	2.75
Aug.	1.46	2.31	2.50	1.70	1.50	2.80	13.60	6.00	4.31	17.75	2.75	12.80	4.56	3.00	3.06	2.95	3.00	2.75	2.73
Sept.	1.50	2.37	2.29	1.65	1.61	2.94	11.12	6.00	4.56	16.70	3.15	11.13	4.50	3.00	3.49	3.38	2.85	2.75	2.65
Oct.	1.50	2.41	2.98	1.60	2.03	4.88	6.00	6.00	4.52	15.12	3.28	9.60	3.85	3.00	6.13	3.63	2.85	2.83	2.65
Nov.	1.52	3.94	1.82	1.52	2.28	6.90	6.00	6.00	5.87	8.26	3.03	7.19	3.81	3.04	5.75	4.43	2.77	2.75	2.60
Dec.	1.60	4.00	1.75	1.50	2.64	8.38	6.00	6.00	6.12	6.20	2.75	7.00	4.00	3.68	4.32	3.50	2.75	2.75	2.64
Average	*1.49*	*2.55*	*2.42*	*1.73*	*1.73*	*3.80*	*9.22*	*6.00*	*4.58*	*11.32*	*3.45*	*7.01*	*5.33*	*3.42*	*3.78*	*3.92*	*3.04*	*2.69*	*2.75*

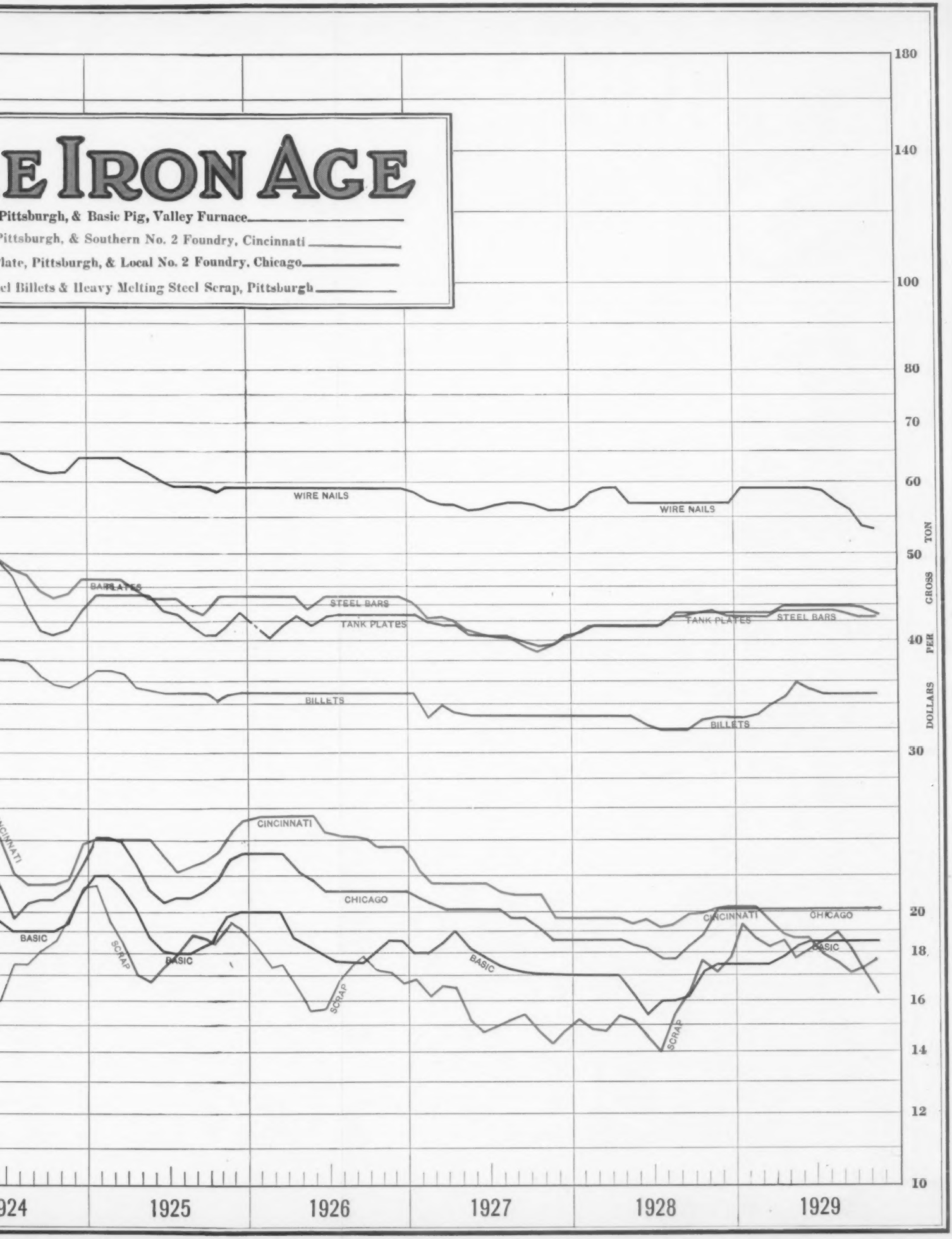
Prompt Connellsville Foundry Coke, per Net Ton at Oven

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan	$1.90	$1.97	$4.40	$2.50	$2.00	$3.50	$9.75	$7.00	$6.25	$7.00	$6.38	$3.75	$8.70	$4.75	$4.88	$7.75	$4.50	$3.75	$3.75
Feb.	2.10	2.09	3.25	2.50	2.00	3.50	11.00	7.00	5.00	7.00	5.63	4.00	8.25	4.88	4.31	8.31	4.31	3.75	3.75
March	2.05	2.56	3.00	2.45	2.00	3.75	11.60	7.00	4.94	7.00	5.45	4.25	8.38	4.88	4.15	4.40	4.40	3.75	3.75
April	2.00	2.69	3.00	2.40	2.00	3.56	9.13	7.00	4.30	10.20	4.75	5.06	7.56	4.75	4.00	4.06	4.06	3.75	3.75
May	1.81	2.58	2.85	2.40	2.00	3.25	8.90	7.00	4.31	13.00	4.50	6.30	6.15	4.69	4.00	4.00	4.00	3.75	3.75
June	1.76	2.40	2.80	2.32	2.00	3.25	11.72	7.00	4.56	15.75	4.45	7.25	5.56	4.38	3.80	4.00	4.00	3.75	3.75
July	1.82	2.40	2.70	2.22	2.05	3.25	13.25	7.00	5.00	17.80	4.06	11.00	5.35	4.10	3.75	4.00	4.00	3.75	3.75
Aug.	1.85	2.40	2.90	2.25	2.00	3.30	13.20	7.00	5.25	18.88	3.75	13.90	5.38	4.00	3.88	4.00	4.00	3.75	3.75
Sept.	1.85	2.54	2.90	2.10	2.07	3.31	11.75	7.00	5.80	17.70	4.15	12.50	5.50	4.00	4.25	4.38	4.00	3.75	3.75
Oct.	1.81	3.65	2.81	2.00	2.35	3.88	6.00	7.00	6.25	16.38	4.38	11.70	4.80	4.00	6.31	4.63	4.00	3.75	3.75
Nov.	1.85	4.25	2.60	1.92	2.88	7.10	7.00	7.00	7.00	9.50	4.19	8.38	4.81	4.06	6.81	5.50	3.85	3.75	3.75
Dec.	1.90	4.50	2.50	1.90	2.95	8.63	7.00	7.00	7.00	7.00	3.81	7.88	4.81	4.55	5.20	4.50	3.75	3.75	3.75
Aver.	*1.89*	*2.84*	*2.98*	*2.25*	*2.19*	*4.19*	*10.03*	*7.00*	*5.47*	*12.27*	*4.63*	*8.00*	*6.27*	*4.42*	*4.61*	*4.96*	*4.11*	*3.75*	*3.75*


DOLLARS PER GROSS TON
Cents per Pound
180
140
100
80
70
60
50
40
30
20
18
16
14
12
10
4
3½
3
2¾
2½
2¼
2
1¾
1½
1¼
1
1914
1915
1916
1917
1918
1919
TANK PLATES
WIRE NAILS
TANK PLATES
STEEL BARS
BILLETS
BASIC
BILLETS
CINCINNATI
CHICAGO
BASIC
SCRAP
WIRE NAILS
STEEL BARS
PLATES
BILLETS
CHICAGO
BASIC
SCRAP
CINCINNATI
BASIC
CHICAGO
SCRAP



n Years of Prices of Pig Iron, Finished and Semi-Finished Steel and Heavy Meltin



Melting Scrap



Heavy Melting Steel Scrap Composite Price

(Average of Pittsburgh, Chicago and Philadelphia Quotations, per Gross Ton)

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$14.02	$10.29	$10.27	$16.46	$21.73	$29.93	$17.77	$25.13	$15.04	$12.45	$20.22	$19.15	$20.08	$16.97	$15.17	$13.70	$17.02
Feb.	13.06	11.39	10.39	16.10	21.35	29.92	14.75	26.00	15.21	12.46	21.46	19.21	18.27	15.50	14.58	13.71	16.96
March	13.10	11.10	10.78	17.28	23.60	29.58	14.52	25.50	13.17	13.46	24.79	17.56	16.92	15.83	14.65	13.65	16.71
April	13.39	10.83	10.61	17.42	26.63	28.47	15.79	24.42	11.63	14.71	24.00	15.20	15.48	15.27	14.71	13.81	17.18
May	12.30	10.60	10.79	16.47	27.63	28.79	15.06	23.71	12.20	15.67	20.77	14.71	15.46	14.35	13.95	13.90	16.54
June	11.60	10.57	10.78	15.25	37.21	28.87	16.54	23.47	11.47	15.52	18.94	14.88	16.09	14.40	13.60	13.52	16.39
July	11.42	10.50	11.65	15.19	36.00	29.00	19.13	24.21	11.00	15.92	17.23	16.00	16.46	15.42	13.48	13.13	16.60
Aug.	11.46	10.42	13.00	15.35	31.30	29.00	20.25	25.88	11.57	16.30	16.58	16.58	17.23	15.88	13.80	13.75	16.86
Sept.	11.35	10.30	13.79	15.67	31.50	29.00	18.87	26.53	12.15	18.33	16.98	17.20	17.39	16.25	13.92	14.75	16.60
Oct.	11.00	9.71	13.62	16.90	26.60	29.00	18.67	23.73	12.88	19.20	15.15	17.08	17.08	15.58	13.48	15.85	15.58
Nov.	10.39	9.13	14.63	20.40	27.83	28.50	20.50	20.00	12.73	18.02	15.13	18.17	17.63	15.25	13.18	15.73	14.83
Dec.	9.97	9.50	16.20	24.13	28.87	25.00	22.77	15.92	12.29	17.94	17.37	20.08	17.39	15.08	13.48	15.97	14.13
Aver.	*11.92*	*10.36*	*12.21*	*17.22*	*28.35*	*28.76*	*17.89*	*23.71*	*12.61*	*15.83*	*19.05*	*17.15*	*17.12*	*15.48*	*14.00*	*14.29*	*16.28*

Scrap Prices at Pittsburgh, per Gross Ton

Heavy Melting Steel

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$14.95	$10.90	$11.63	$17.50	$22.60	$30.00	$19.00	$26.30	$15.50	$14.30	$21.80	$21.38	$21.50	$18.63	$16.88	$15.10	$19.31
Feb.	14.19	12.62	11.63	17.06	21.75	30.00	14.75	27.75	16.00	14.00	23.25	20.88	19.50	17.50	16.13	14.94	18.63
March	14.19	12.12	12.00	18.45	23.25	30.00	14.00	27.25	14.00	15.13	25.38	19.38	18.50	17.55	16.55	14.81	18.44
April	14.19	12.00	11.81	17.81	28.00	28.50	15.20	26.00	12.63	16.38	25.88	16.20	17.00	16.63	16.50	15.31	18.60
May	13.55	12.00	11.75	16.95	28.80	28.50	14.75	25.00	13.30	17.30	22.80	15.63	16.75	15.69	15.40	15.25	17.88
June	12.62	12.00	11.75	15.88	41.00	28.62	17.12	25.00	12.69	17.00	21.13	16.00	17.30	15.75	14.81	14.56	18.25
July	12.40	12.00	12.31	16.31	39.00	29.00	19.70	26.00	12.00	17.38	18.10	17.50	18.00	16.81	15.00	14.10	18.55
Aug.	12.37	11.50	13.81	16.05	32.83	29.00	21.00	28.13	12.70	17.75	17.75	17.50	18.88	17.50	15.40	15.50	19.00
Sept.	12.25	11.31	14.30	16.19	33.25	29.00	19.20	29.00	13.63	20.13	17.88	18.10	18.70	17.88	15.50	16.56	18.31
Oct.	11.85	10.85	14.38	18.25	28.80	29.00	19.00	27.75	14.13	21.40	15.70	18.50	18.50	17.25	14.75	17.60	17.30
Nov.	11.44	10.00	15.88	21.20	29.50	28.87	22.25	23.50	14.30	20.50	16.13	19.63	19.50	17.20	14.25	17.19	16.39
Dec.	11.08	10.75	17.45	26.00	30.00	26.87	24.25	17.20	14.25	20.13	18.75	21.40	19.10	16.75	14.88	17.90	15.45
Aver.	*12.92*	*11.50*	*13.23*	*18.14*	*29.90*	*28.95*	*18.85*	*25.74*	*13.76*	*17.62*	*20.38*	*18.51*	*18.60*	*17.10*	*15.50*	*15.74*	*18.01*

Machine Shop Turnings

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$9.60	$16.90	$15.75	$17.50	$14.30	$12.00	$10.80	$11.50
Feb	9.56	18.50	16.13	15.88	13.63	11.38	10.88	11.50
March	10.50	20.38	14.50	14.20	13.35	12.00	10.25	10.63
April	11.88	20.50	12.45	13.39	12.00	12.63	10.44	11.15
May	13.30	19.20	11.88	12.25	11.00	11.30	10.20	11.06
June	13.32	17.19	13.00	13.05	11.00	10.50	9.00	11.63
July	14.00	12.10	13.50	13.63	11.38	11.50	9.10	11.90
Aug.	14.00	11.44	14.13	15.00	12.80	11.80	9.88	13.00
Sept.	14.75	12.88	14.40	14.75	13.06	11.63	11.13	12.06
Oct.	16.20	11.60	14.25	14.39	12.06	11.50	11.10	11.75
Nov.	16.63	11.63	15.94	15.00	11.90	11.10	11.00	11.00
Dec.	15.63	13.75	17.20	14.30	11.56	11.00	11.10	10.00
Aver.	*13.28*	*15.51*	*14.43*	*14.44*	*12.34*	*11.53*	*10.41*	*11.43*

Compressed Sheets

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$11.80	$20.50	$18.88	$20.00	$17.63	$15.50	$14.15	$18.81
Feb.	12.00	21.75	19.63	18.00	16.13	15.06	14.06	18.31
March	13.13	23.75	17.50	17.35	15.60	15.45	14.56	18.25
April	14.63	24.75	14.60	15.63	15.25	15.56	14.94	18.55
May	15.10	24.30	13.75	15.46	14.75	14.40	14.90	17.81
June	15.13	19.88	14.38	16.30	14.60	13.75	14.25	18.13
July	15.50	16.90	15.70	16.63	15.50	14.31	13.60	18.25
Aug.	16.10	16.13	16.00	17.39	16.40	14.45	14.75	18.44
Sept.	17.88	16.00	16.55	17.40	16.50	14.50	16.39	18.19
Oct.	19.50	14.30	16.50	17.39	15.63	14.50	17.15	17.15
Nov.	19.50	14.25	17.75	18.00	16.00	13.70	17.00	16.13
Dec.	19.38	16.50	19.40	18.00	15.56	13.94	17.80	14.80
Aver.	*15.80*	*19.08*	*16.72*	*17.27*	*15.80*	*14.59*	*15.30*	*17.74*

No. 1 Cast Cupola Scrap

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.30	$23.30	$21.00	$19.63	$17.50	$16.00	$14.50	$16.00
Feb.	16.00	24.75	21.38	20.13	17.00	15.56	14.50	15.00
March	15.94	26.75	20.25	18.60	17.00	15.80	14.50	15.13
April	16.88	27.75	18.50	17.75	16.50	16.00	14.50	15.39
May	18.50	26.30	17.88	17.50	16.50	15.70	14.50	15.50
June	18.75	24.13	17.25	17.10	15.90	15.13	14.25	15.50
July	19.00	21.10	17.80	17.00	15.75	15.00	14.25	15.50
Aug.	19.00	21.38	18.00	17.50	16.80	15.00	14.50	15.50
Sept.	22.13	21.75	18.00	17.40	16.50	15.00	14.94	15.50
Oct.	24.00	19.50	18.00	17.39	16.00	14.75	15.40	15.50
Nov.	23.13	18.63	18.13	18.00	16.30	14.35	15.00	15.13
Dec.	22.38	20.00	19.10	17.70	16.00	14.38	14.80	14.00
Aver.	*19.33*	*22.95*	*18.77*	*17.98*	*16.48*	*15.22*	*14.64*	*15.30*

Cast Iron Borings

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$10.90	$18.40	$16.94	$17.50	$14.88	$12.50	$11.30	$12.88
Feb.	11.06	19.50	16.88	15.88	14.13	12.13	11.00	12.50
March	11.94	21.13	15.38	14.10	13.30	12.50	10.50	12.25
April	13.38	21.88	13.00	13.39	12.50	12.38	11.00	12.45
May	14.10	20.20	12.75	12.50	11.75	11.10	10.90	12.00
June	14.63	17.88	14.00	13.05	11.90	10.50	10.39	12.25
July	16.00	15.20	13.80	13.63	12.38	10.63	10.00	12.40
Aug.	15.70	13.88	14.75	15.00	12.75	11.00	10.75	12.75
Sept.	17.00	15.63	14.90	14.75	12.94	11.00	12.13	12.25
Oct.	18.60	13.50	15.00	14.39	12.50	11.00	12.50	12.25
Nov.	17.85	12.75	15.13	15.00	12.90	11.00	12.13	11.63
Dec.	17.50	14.88	16.70	14.90	12.13	11.13	12.00	10.50
Aver.	*14.89*	*17.07*	*14.94*	*14.51*	*12.84*	*11.57*	*11.22*	*12.18*

Low-Phosphorus Scrap, at Pittsburgh; Billet and Bloom Crops; Per Gross Ton

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$17.60	$25.30	$23.60	$26.50	$24.00	$21.00	$18.50	$22.00
Feb.	17.13	27.50	25.13	24.75	22.25	20.25	18.50	22.00
March	17.38	32.00	24.00	23.30	22.00	20.30	18.50	22.50
April	18.88	32.25	19.40	22.13	21.13	21.00	18.50	23.46
May	20.00	28.60	19.50	21.63	20.00	20.00	18.60	22.50
June	20.00	25.88	20.13	22.00	20.00	19.25	19.00	22.25
July	20.13	22.00	20.90	22.00	20.75	19.00	19.00	22.45
Aug.	21.20	23.50	21.88	22.25	21.00	19.00	19.13	23.00
Sept.	24.25	24.38	22.60	23.00	21.67	20.00	19.88	22.39
Oct.	25.00	21.90	23.00	23.13	20.50	19.25	20.20	21.75
Nov.	24.00	20.50	23.25	24.00	20.60	18.30	20.50	21.13
Dec.	24.00	21.75	25.13	24.00	21.13	18.50	21.00	20.50
Aver.	*20.80*	*25.46*	*22.39*	*23.22*	*21.25*	*19.65*	*19.28*	*22.16*

No. 1 Railroad Cast Scrap at Cincinnati

(Per Net Ton)

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$12.00	$17.20	$17.25	$17.38	$15.75	$14.00	$12.00	$15.39
Feb.	11.63	19.50	17.75	15.88	15.00	13.00	12.00	15.31
March	12.00	21.75	16.25	15.50	14.50	13.00	11.60	15.25
April	13.25	22.00	14.00	15.13	14.10	13.00	11.60	15.25
May	14.00	20.60	13.00	15.00	13.50	13.00	11.43	15.25
June	14.00	18.00	13.38	15.90	13.63	13.00	11.39	15.25
July	14.00	16.70	14.50	16.00	14.50	13.00	11.39	15.25
Aug.	14.40	16.25	14.50	15.63	14.75	13.00	11.39	15.25
Sept.	16.13	16.88	15.30	15.50	15.00	13.00	11.60	15.25
Oct.	18.00	14.50	14.88	15.00	14.39	12.50	12.60	15.20
Nov.	17.13	13.66	15.63	15.88	14.00	12.25	13.17	15.00
Dec.	16.63	15.00	16.38	16.00	14.00	12.00	13.35	15.00
Aver.	*14.43*	*17.67*	*15.23*	*15.73*	*14.42*	*12.90*	*11.96*	*15.22*

No. 1 Machinery Cast Scrap at Cincinnati

(Per Net Ton)

	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$14.00	$20.39	$20.50	$20.12	$19.75	$17.00	$14.30	$19.20
Feb.	13.63	21.75	21.50	19.12	19.39	16.00	14.30	19.31
March	14.05	23.65	20.00	18.35	19.00	16.00	13.85	19.25
April	15.50	24.75	18.00	17.75	17.80	16.00	13.85	19.25
May	16.25	24.05	16.75	17.75	17.00	15.60	13.65	19.25
June	16.25	22.13	17.13	18.15	17.00	15.50	13.60	19.25
July	16.25	20.25	18.25	18.25	17.00	15.50	13.55	19.25
Aug.	17.45	19.05	18.25	19.00	17.63	15.50	13.40	19.10
Sept.	19.88	19.38	18.13	19.25	18.00	15.50	14.20	19.00
Oct.	21.25	18.00	17.68	19.00	17.39	15.50	15.65	18.95
Nov.	20.85	16.85	18.40	20.13	17.00	14.50	16.70	18.56
Dec.	20.75	18.00	18.75	20.00	17.00	14.00	16.60	18.50
Aver.	*17.17*	*20.69*	*18.69*	*18.91*	*17.83*	*15.55*	*14.47*	*19.07*

Scrap Prices at Chicago, per Gross Ton

Heavy Melting Steel

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$12.60	$9.35	$9.19	$15.50	$21.12	$30.00	$17.40	$24.50	$15.13	$11.45	$19.15	$17.69	$19.44	$15.12	$13.25	$12.50	$15.39
Feb.	12.13	10.50	8.56	14.75	21.50	30.25	15.06	25.00	15.13	11.38	20.33	17.88	17.69	13.88	13.00	12.69	15.88
March	12.08	9.81	9.63	16.50	23.70	29.87	15.63	24.25	12.50	12.38	23.50	16.56	16.45	13.95	12.90	12.63	15.66
April	12.50	9.80	9.15	16.50	27.00	28.75	16.41	23.75	11.00	13.75	22.50	14.10	14.81	13.19	13.13	12.63	15.95
May	11.25	9.69	9.37	15.94	28.70	28.80	15.62	23.00	11.50	14.95	19.70	13.75	15.00	12.13	12.35	12.95	15.39
June	10.44	9.75	9.44	14.80	36.50	29.00	16.69	22.95	10.81	14.56	17.88	13.63	15.75	12.45	12.00	12.63	14.94
July	10.50	9.75	10.40	14.50	33.00	29.00	19.40	24.13	10.00	15.25	17.05	14.90	15.60	14.19	12.06	12.30	14.75
Aug.	10.56	9.69	11.56	15.25	29.60	29.00	20.88	25.35	10.60	15.95	16.00	15.50	16.44	14.00	12.30	12.75	15.06
Sept.	10.06	9.19	11.75	16.06	31.25	29.00	19.10	24.81	11.31	18.13	16.31	16.40	16.35	14.00	12.25	12.94	15.13
Oct.	10.00	8.50	11.75	16.81	26.00	29.00	18.25	21.50	12.44	18.40	14.15	16.13	16.00	13.00	11.69	13.95	14.30
Nov.	9.56	8.06	13.44	26.60	27.60	28.50	20.88	18.45	12.25	17.31	14.00	17.13	16.00	13.00	11.50	14.50	13.15
Dec.	9.00	8.43	15.63	23.00	28.37	22.75	21.80	16.20	11.13	17.25	16.06	18.95	15.75	13.00	12.06	14.55	12.50
Aver.	*10.89*	*9.38*	*10.91*	*16.68*	*27.86*	*28.66*	*18.09*	*22.82*	*11.98*	*15.06*	*18.05*	*16.05*	*16.27*	*13.49*	*12.39*	*13.09*	*14.84*

Old Steel Rerolling Rails

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.15	$11.10	$9.62	$17.06	$27.00	$35.00	$22.10	$34.25	$15.63	$12.10	$20.40	$18.88	$21.75	$17.50	$16.38	$14.90	$17.00
Feb.	15.50	11.81	9.87	17.06	27.00	35.00	16.44	34.38	15.50	12.00	21.75	20.13	19.25	16.63	15.94	15.00	17.50
March	15.00	11.56	10.25	17.65	28.00	34.75	16.38	32.30	13.30	13.31	24.63	19.13	17.86	16.50	15.60	14.44	17.50
April	14.63	11.50	10.25	18.00	32.62	33.50	17.55	32.13	12.63	14.50	23.75	16.30	16.00	16.13	16.00	13.81	17.50
May	13.95	11.31	10.25	17.38	36.50	34.00	17.75	31.75	13.40	15.70	21.70	15.00	16.88	15.19	15.20	14.40	17.50
June	12.69	11.50	10.25	15.85	46.90	34.00	18.75	32.65	12.94	15.25	19.25	14.81	17.85	15.45	14.75	14.81	17.50
July	12.25	11.50	10.30	15.25	45.19	34.00	25.15	35.00	12.25	16.13	18.00	15.50	17.44	17.19	14.88	14.75	17.50
Aug.	12.12	11.50	12.25	15.80	39.20	34.00	29.50	38.00	12.45	16.90	17.50	16.19	19.00	17.10	15.30	15.13	17.75
Sept.	12.25	10.75	13.35	17.06	39.75	34.00	26.80	38.13	13.13	19.38	17.38	17.30	19.25	17.39	15.19	15.88	17.81
Oct.	12.15	10.00	13.31	18.81	34.75	34.00	27.19	33.44	14.00	20.30	15.80	17.06	18.88	16.63	14.88	16.50	17.20
Nov.	12.00	9.50	14.44	24.50	34.80	33.50	31.25	22.90	13.80	18.38	15.06	18.19	19.44	16.50	14.50	16.63	15.50
Dec.	11.33	9.50	16.63	28.63	35.25	27.50	31.90	16.90	12.63	17.75	17.00	20.36	19.10	16.19	14.63	16.60	14.60
Aver.	*13.34*	*10.96*	*11.73*	*18.59*	*35.58*	*33.60*	*23.40*	*31.90*	*13.47*	*15.98*	*19.35*	*17.40*	*18.56*	*16.53*	*15.27*	*15.24*	*17.07*

Cast Iron Borings

	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$10.08	$18.48	$12.54	$16.11	$10.92	$6.38	$15.57	$13.58	$15.56	$13.39	$10.06	$10.40	$12.50
Feb.	10.15	18.48	8.75	16.39	11.76	6.93	16.59	15.55	14.63	12.06	10.13	10.13	12.00
March	10.64	18.48	10.15	15.74	8.40	8.05	18.91	14.38	13.85	11.75	10.20	9.63	10.63
April	11.83	17.99	10.47	15.96	7.28	9.24	17.92	11.40	10.94	10.94	10.44	9.31	10.40
May	13.44	17.53	9.31	14.43	6.61	10.98	16.24	10.00	10.00	9.75	10.00	9.25	10.19
June	19.60	17.77	9.33	13.38	5.60	11.63	14.43	10.06	10.70	9.95	9.56	9.00	9.88
July	20.01	18.48	12.71	14.15	5.32	12.67	13.66	10.45	11.13	11.19	9.94	9.05	9.75
Aug.	18.36	18.48	14.28	15.06	5.38	12.88	12.04	10.69	12.75	11.45	10.50	9.31	10.19
Sept.	18.20	18.48	13.55	14.65	5.60	14.43	12.19	11.80	13.15	11.19	10.75	9.75	10.50
Oct.	15.75	18.48	11.63	12.88	6.44	14.90	10.42	11.56	12.75	8.88	10.13	10.75	10.00
Nov.	17.25	16.80	12.88	11.93	6.83	14.56	10.08	12.63	13.19	9.20	9.60	11.69	9.25
Dec.	18.05	14.84	14.17	10.98	6.09	14.56	12.04	14.36	13.50	9.50	10.19	11.85	9.15
Aver.	*15.28*	*17.94*	*11.65*	*14.30*	*7.19*	*11.43*	*14.17*	*12.21*	*12.68*	*10.77*	*10.13*	*10.01*	*10.37*

Steel Knuckles and Couplers

	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$25.20	$37.52	$24.51	$27.44	$16.39	$12.77	$24.98	$21.21	$22.88	$18.00	$16.25	$14.65	$16.50
Feb.	25.20	36.89	19.32	29.68	16.11	12.39	26.53	21.77	21.00	17.13	16.00	14.50	17.00
March	26.60	35.00	19.60	27.66	13.55	14.12	28.71	20.00	18.70	16.70	15.60	14.06	17.00
April	30.67	34.00	19.21	26.32	12.47	15.68	27.93	17.40	17.63	16.44	15.69	13.81	17.30
May	33.71	34.00	17.36	25.48	13.66	16.69	25.42	17.00	17.63	15.39	14.80	14.50	17.13
June	43.83	34.00	18.20	25.20	13.16	15.89	22.55	16.63	19.00	15.30	14.25	14.25	16.75
July	45.92	34.00	20.50	27.16	11.63	17.92	21.00	17.30	18.19	17.39	14.25	13.75	16.75
Aug.	44.24	34.00	23.52	29.01	12.21	19.21	20.87	18.00	19.50	17.50	14.40	14.00	16.94
Sept.	40.88	34.00	21.95	27.72	13.03	21.84	21.56	19.35	19.50	17.39	14.00	14.75	17.00
Oct.	33.38	34.00	21.43	24.51	14.84	22.96	18.93	18.25	18.63	16.06	13.25	15.75	17.00
Nov.	33.04	34.00	23.39	20.83	14.28	21.84	17.64	19.63	18.75	15.50	13.00	16.00	16.39
Dec.	35.67	32.55	24.86	16.95	12.60	22.12	19.88	22.78	18.25	15.50	13.69	16.00	16.00
Aver.	*34.86*	*34.50*	*21.15*	*25.67*	*13.66*	*17.79*	*23.00*	*19.10*	*19.14*	*16.53*	*14.60*	*14.67*	*16.81*

Railroad Malleable Scrap

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$15.01	$10.36	$9.11	$15.47	$19.88	$30.02	$19.71	$32.48	$16.52	$12.77	$25.26	$20.93	$21.13	$18.00	$16.06	$13.60	$18.69
Feb.	14.56	11.63	8.96	14.93	19.39	30.02	16.65	33.53	17.36	12.81	26.75	21.77	20.00	17.56	16.06	13.50	19.39
March	14.56	10.71	8.89	15.62	20.10	31.24	18.07	31.92	15.46	13.87	28.56	21.00	19.10	17.60	16.00	12.63	19.39
April	14.77	10.25	8.96	15.56	22.81	31.64	17.70	30.95	13.59	15.68	28.00	19.30	17.50	17.39	15.88	12.75	19.35
May	13.55	10.24	9.12	15.05	26.10	32.82	17.08	29.68	14.11	16.80	25.54	18.13	17.63	16.50	14.45	13.00	18.56
June	12.39	10.08	9.11	13.14	35.41	33.04	17.92	28.73	12.88	16.73	24.08	16.88	18.00	16.60	13.50	12.69	17.81
July	11.87	10.08	9.97	13.03	33.73	33.28	20.94	30.24	12.53	17.51	22.51	17.00	17.88	17.81	13.63	12.50	16.85
Aug.	11.63	9.95	11.20	12.60	33.26	34.01	22.96	32.20	13.44	19.04	20.59	17.38	19.13	17.75	14.50	12.88	16.94
Sept.	11.41	9.24	11.48	12.88	34.44	34.01	21.22	30.95	14.63	23.67	21.71	18.20	19.10	17.39	13.69	14.39	17.00
Oct.	10.81	8.85	11.48	13.87	28.28	34.01	21.35	26.32	15.12	24.42	19.60	18.13	18.50	16.50	13.13	15.30	17.00
Nov.	10.43	8.68	12.75	17.92	28.67	32.68	25.89	21.78	14.67	23.11	18.91	19.00	19.19	16.50	12.55	15.88	16.39
Dec.	10.08	8.90	15.40	20.16	30.63	25.48	28.78	16.80	12.81	22.40	20.23	20.28	18.30	16.00	12.81	17.00	16.10
Aver.	*12.59*	*9.91*	*10.53*	*15.02*	*27.72*	*31.85*	*20.85*	*28.80*	*14.43*	*18.23*	*23.48*	*19.00*	*18.79*	*17.13*	*14.36*	*13.85*	*17.79*

Old Cast Iron Carwheels

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.95	$11.65	$9.94	$14.63	$18.87	$30.00	$25.90	$36.13	$21.00	$15.30	$26.70	$20.50	$21.38	$18.00	$15.31	$13.90	$14.13
Feb.	16.75	12.44	10.00	13.94	18.25	30.00	22.75	38.06	20.63	15.00	27.25	21.00	19.38	17.13	15.13	14.00	14.50
March	16.75	11.88	9.94	14.30	20.25	30.00	21.50	36.20	15.90	16.50	28.38	21.00	17.10	17.00	15.00	13.88	14.50
April	16.75	11.55	9.75	13.88	23.62	29.00	21.50	37.50	14.06	18.63	27.75	16.70	16.00	16.39	15.00	13.50	14.50
May	15.05	11.50	9.75	12.95	27.35	29.00	21.25	37.50	14.70	18.50	24.10	16.25	16.06	15.25	14.05	13.45	14.50
June	13.94	11.50	10.19	12.44	39.00	29.00	22.00	35.90	13.31	18.25	21.88	15.63	17.30	15.30	13.50	13.06	14.39
July	12.90	11.25	11.30	12.50	35.25	29.00	23.95	35.75	12.75	19.25	20.60	16.40	17.12	16.39	13.75	12.80	14.00
Aug.	12.75	11.25	11.04	11.80	30.40	29.00	26.25	38.35	12.95	20.60	19.50	17.13	17.50	15.90	14.50	12.75	14.00
Sept.	12.63	11.06	11.80	11.69	31.87	29.00	24.90	37.69	14.19	23.75	19.75	18.20	17.70	15.25	14.25	13.31	14.00
Oct.	12.10	10.65	12.00	12.94	25.75	29.00	24.88	36.06	16.50	25.10	17.90	17.63	17.38	14.50	13.56	13.85	14.00
Nov.	12.00	9.81	13.31	17.30	28.15	29.00	28.63	31.95	16.60	24.63	17.88	18.63	18.31	14.50	13.25	14.25	13.88
Dec.	11.88	9.69	14.56	21.25	31.00	26.75	31.10	24.40	15.75	24.00	19.75	20.70	18.30	14.50	13.44	14.10	13.60
Aver.	*14.20*	*11.18*	*11.13*	*14.12*	*27.46*	*29.06*	*24.55*	*35.46*	*15.70*	*19.96*	*22.62*	*18.31*	*17.79*	*15.84*	*14.28*	*13.57*	*14.17*

No. 1 Railroad Wrought, at Chicago, per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$12.70	$8.70	$8.69	$15.88	$23.50	$31.25	$19.10	$26.00	$13.63	$10.50	$17.75	$15.31	$17.44	$13.50	$12.50	$11.10	$13.63
Feb.	12.19	9.50	8.87	14.94	23.75	31.25	15.13	27.00	13.50	10.44	18.38	15.38	16.13	12.88	12.31	11.13	14.25
March	12.13	9.06	9.00	16.20	25.90	30.75	15.88	27.10	11.60	11.50	20.88	14.06	14.60	12.95	12.10	11.00	14.00
April	12.38	9.00	8.65	17.00	30.35	30.20	16.05	27.25	10.00	12.13	20.00	12.75	13.00	12.44	12.39	11.25	14.15
May	11.25	9.00	8.94	16.50	32.60	29.75	15.69	26.38	10.40	12.90	17.60	12.00	13.44	10.94	11.35	11.60	14.13
June	10.56	9.00	9.00	15.20	41.00	29.75	16.87	25.25	9.63	12.69	15.50	11.56	14.65	11.60	11.00	11.31	13.63
July	10.55	9.00	9.15	14.94	37.75	29.75	18.60	24.88	9.25	13.63	14.60	12.80	14.19	13.31	11.39	10.85	13.50
Aug.	10.62	8.94	10.44	15.30	33.70	29.75	20.75	24.75	10.45	14.75	14.25	13.75	16.00	13.50	11.70	11.06	13.88
Sept.	10.19	8.37	11.00	16.38	35.50	29.75	19.50	23.88	11.50	17.62	15.63	14.80	15.50	13.50	11.25	11.81	14.00
Oct.	9.60	7.87	11.19	17.50	28.75	30.36	19.38	20.25	13.00	17.75	13.20	14.25	14.38	12.81	10.19	12.60	13.70
Nov.	9.00	7.56	12.94	21.00	30.90	28.68	22.88	16.85	12.20	15.81	12.50	15.50	15.63	12.50	9.60	13.13	12.44
Dec.	8.50	7.90	15.38	25.13	31.25	24.62	24.10	14.60	10.44	15.13	15.00	16.81	13.95	12.00	10.44	13.25	12.00
Aver.	*10.81*	*8.66*	*10.27*	*17.16*	*31.25*	*29.66*	*18.66*	*23.58*	*11.30*	*13.74*	*16.27*	*14.08*	*14.91*	*12.66*	*11.35*	*11.67*	*13.30*

No. 1 Machinery Cast Scrap, at Chicago, per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$12.90	$10.20	$9.19	$13.31	$15.50	$25.90	$22.95	$37.25	$17.25	$12.90	$21.60	$20.38	$19.88	$17.00	$16.50	$14.50	$15.81
Feb.	12.69	10.87	9.00	12.81	15.37	26.06	20.00	38.88	18.00	13.25	23.63	21.00	18.75	17.00	16.50	14.50	16.25
March	12.50	10.37	9.00	13.45	16.90	27.25	21.63	37.85	14.90	14.13	26.25	20.13	18.20	17.00	16.50	14.50	16.00
April	12.44	10.25	9.00	12.88	20.43	27.12	21.45	37.25	13.25	14.88	25.75	18.40	17.25	16.39	16.50	14.13	16.00
May	11.60	10.06	9.00	12.56	23.20	26.70	20.12	37.38	13.60	16.20	23.30	17.38	16.88	15.88	15.80	14.00	15.39
June	10.63	9.75	9.00	11.75	30.00	27.12	20.75	36.30	12.75	16.06	21.75	16.75	17.50	16.15	14.50	13.88	14.75
July	10.70	9.65	9.25	11.50	29.25	28.06	23.30	36.50	12.25	17.00	19.60	16.90	17.50	17.19	14.50	13.50	14.50
Aug.	10.87	9.50	9.62	11.50	24.20	29.10	24.50	36.20	12.60	18.60	18.00	17.50	17.63	17.00	14.80	13.94	14.50
Sept.	10.62	9.19	10.10	12.13	23.75	30.00	24.20	34.00	13.44	21.38	19.63	18.20	17.90	16.88	14.56	14.81	14.50
Oct.	10.40	9.00	10.50	13.50	20.50	30.36	25.00	28.75	13.88	20.80	18.70	17.50	17.63	16.50	14.25	15.40	14.50
Nov.	10.06	8.56	12.13	15.55	22.00	28.87	28.12	23.00	13.50	20.25	18.38	17.88	18.19	16.00	13.50	15.50	13.63
Dec.	9.83	9.00	13.75	16.25	23.50	25.75	32.35	18.70	12.63	19.75	19.75	19.20	17.25	16.13	14.00	15.60	13.50
Aver.	*11.27*	*9.70*	*9.96*	*13.10*	*22.05*	*27.69*	*23.70*	*33.51*	*14.00*	*17.10*	*21.36*	*18.44*	*17.88*	*16.59*	*15.16*	*14.39*	*15.11*

Philadelphia Scrap Prices, Delivered Eastern Pennsylvania, Per Gross Ton

Heavy Melting Steel

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$14.40	$10.40	$10.00	$16.38	$21.70	$30.00	$17.20	$24.75	$14.50	$11.60	$19.70	$18.20	$18.50	$17.00	$15.39	$13.50	$16.39
Feb.	12.87	11.00	10.00	16.50	20.63	30.00	14.75	25.62	14.25	12.00	20.75	18.38	17.63	15.88	14.63	13.50	16.39
March	13.25	11.31	10.80	16.90	23.50	29.00	14.19	25.20	13.00	12.78	25.25	16.75	15.90	16.00	14.50	13.50	16.13
April	13.34	10.95	11.00	17.88	24.88	28.00	15.50	24.12	11.25	14.00	23.63	15.30	14.63	16.00	14.50	13.50	17.00
May	12.10	10.63	11.25	16.60	25.40	29.00	15.00	23.37	11.80	14.75	19.80	14.75	14.63	15.25	14.10	13.50	16.39
June	11.75	10.50	11.10	15.31	34.13	29.00	16.12	22.60	11.25	15.00	17.88	15.00	15.10	14.70	14.00	13.39	16.00
July	11.35	10.30	12.06	14.94	35.20	29.00	18.90	22.62	11.00	15.00	16.60	15.40	15.63	14.63	13.39	13.00	16.50
Aug.	11.43	10.19	13.75	14.75	31.88	29.00	19.37	25.00	11.40	15.20	16.00	16.75	16.38	16.20	13.70	13.00	16.50
Sept.	11.62	10.69	15.00	14.75	30.25	29.00	18.62	25.62	11.50	16.88	16.75	17.10	17.20	16.88	14.00	14.75	16.39
Oct.	11.15	9.95	14.75	15.63	25.00	29.00	19.10	22.75	12.06	17.80	15.40	16.63	16.75	16.50	14.00	16.00	15.70
Nov.	10.19	9.25	14.65	20.13	26.00	28.00	20.62	19.00	11.88	16.25	15.25	17.75	17.38	15.50	13.80	15.50	15.00
Dec.	10.00	9.40	15.81	23.75	28.20	25.00	22.50	15.25	11.50	16.38	16.75	20.10	17.50	15.50	13.50	15.40	14.50
Aver.	*11.96*	*10.38*	*12.51*	*16.96*	*27.23*	*28.67*	*17.66*	*22.99*	*12.12*	*14.80*	*18.65*	*16.84*	*16.44*	*15.84*	*14.13*	*14.05*	*16.07*

No. 1 Machinery Cast

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$14.50	$12.00	$12.00	$17.00	$20.20	$30.00	$23.80	$36.00	$23.25	$16.50	$23.20	$20.70	$20.13	$18.39	$17.00	$16.00	$16.31
Feb.	14.37	12.88	12.00	17.00	20.00	30.00	23.00	40.00	23.00	16.50	24.25	20.25	18.88	17.75	17.00	16.00	16.50
March	14.00	13.00	12.00	17.00	21.75	30.00	21.25	39.20	19.40	17.13	28.25	18.63	18.00	17.50	17.00	16.00	16.25
April	13.94	13.00	11.75	17.88	26.63	29.00	22.00	38.00	18.00	17.25	26.25	17.70	17.25	17.50	17.00	16.00	16.50
May	13.60	12.25	12.13	17.50	29.00	29.00	21.50	37.75	18.00	18.40	24.30	17.00	17.00	17.25	16.80	16.00	16.50
June	13.25	12.00	12.25	16.50	33.50	29.00	22.00	37.00	17.38	19.00	22.25	17.50	17.50	17.00	16.00	16.00	16.50
July	13.00	12.00	12.38	16.00	36.30	29.00	22.10	37.50	16.50	17.50	20.40	17.50	17.63	17.00	16.00	15.50	16.50
Aug.	12.87	12.00	13.30	16.00	33.25	29.00	24.75	39.00	17.00	18.60	20.38	17.88	18.00	17.70	16.00	15.50	16.50
Sept.	12.81	12.00	14.00	16.00	31.00	29.00	25.00	39.25	17.00	21.50	21.38	18.00	18.00	18.00	16.38	16.25	16.88
Oct.	13.50	11.40	14.00	16.15	28.00	29.00	25.20	38.75	17.13	22.60	19.50	17.50	18.00	17.39	16.50	17.10	16.00
Nov.	12.62	11.00	14.50	18.50	30.00	29.00	27.62	33.80	17.50	21.00	19.25	17.88	18.00	17.30	16.13	16.39	15.88
Dec.	12.17	11.30	16.06	20.75	30.60	29.00	30.75	24.50	16.63	20.25	20.25	19.50	18.13	17.00	16.00	16.25	15.00
Aver.	*13.39*	*12.07*	*13.03*	*17.19*	*28.35*	*29.25*	*24.08*	*36.73*	*18.49*	*18.85*	*22.47*	*18.34*	*18.04*	*17.48*	*16.48*	*16.08*	*16.28*

No. 1 Railroad Wrought

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.10	$13.05	$12.00	$22.00	$26.60	$35.00	$24.20	$33.50	$20.00	$14.50	$22.10	$20.90	$20.88	$18.39	$17.00	$15.25	$15.50
Feb.	15.12	14.38	12.00	21.63	25.50	35.00	21.50	36.00	19.75	14.63	24.75	21.50	20.13	17.75	17.00	15.06	16.00
March	15.25	14.00	12.50	22.13	30.75	35.00	20.25	35.90	17.20	15.38	27.50	19.00	18.90	17.20	17.00	14.60	16.00
April	15.37	13.25	12.69	23.38	36.00	35.00	21.60	35.00	17.00	15.88	27.00	18.10	17.75	17.50	16.50	14.50	16.00
May	15.00	12.63	12.94	22.50	41.40	34.00	21.00	33.50	15.20	16.90	24.20	16.63	17.50	17.25	16.50	14.50	16.00
June	14.75	12.50	13.00	20.50	51.25	34.00	21.50	33.00	14.38	17.00	22.50	16.50	18.10	16.60	16.00	13.75	16.00
July	13.90	12.20	13.44	19.50	50.60	34.00	24.40	33.00	13.50	17.13	18.80	17.70	17.63	16.50	15.75	13.50	16.00
Aug.	14.00	12.00	14.95	20.20	45.00	34.00	26.50	33.00	14.00	18.00	18.00	18.63	17.50	17.80	15.50	13.50	16.00
Sept.	14.68	12.38	16.50	20.00	44.00	34.00	26.50	33.25	15.00	20.88	18.50	19.00	17.70	17.88	15.50	14.50	16.00
Oct.	14.00	11.80	16.13	21.63	37.20	34.00	26.90	29.25	15.88	22.20	17.50	18.00	18.13	17.00	15.50	15.60	16.00
Nov.	13.00	11.50	16.50	24.13	35.00	34.00	28.37	25.00	16.00	19.00	17.38	18.38	18.50	17.00	15.30	16.00	15.88
Dec.	12.75	11.50	20.06	26.75	35.00	33.00	30.25	20.00	14.63	19.25	18.50	20.40	18.50	17.00	15.25	16.00	15.40
Aver.	*14.49*	*12.60*	*14.39*	*22.03*	*38.19*	*34.25*	*24.41*	*31.70*	*16.04*	*17.56*	*21.39*	*18.73*	*18.44*	*17.32*	*16.07*	*14.73*	*15.90*

Old Cast Iron Carwheels

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$16.20	$12.20	$11.00	$16.38	$21.50	$30.00	$24.60	$36.00	$25.00	$16.50	$22.30	$20.10	$19.50	$18.13	$16.38	$15.50	$16.50
Feb.	15.37	12.63	10.63	16.50	20.50	30.00	23.00	40.62	24.00	15.00	24.75	20.38	18.38	17.50	16.00	15.50	16.50
March	15.00	12.50	11.00	16.70	21.50	30.00	23.00	42.40	18.50	15.94	26.50	18.75	18.50	17.50	16.00	15.50	16.50
April	14.87	12.00	11.00	17.38	25.75	29.00	23.10	40.00	18.00	15.88	26.50	17.50	17.75	17.50	16.00	15.50	16.50
May	13.75	11.75	11.38	16.70	28.00	29.00	21.00	40.00	16.80	16.70	24.20	17.00	17.00	17.25	16.00	15.50	16.39
June	13.12	11.19	11.55	16.38	34.00	29.00	22.00	38.00	18.00	17.13	22.75	17.00	17.00	17.00	15.38	15.50	16.00
July	12.30	11.00	12.38	15.63	36.20	29.00	23.20	38.50	16.50	17.50	20.40	17.30	17.25	17.00	15.00	15.50	16.39
Aug.	12.37	11.25	13.25	15.50	34.50	29.00	24.50	40.60	16.40	18.10	20.25	17.75	18.50	17.40	15.30	15.50	16.50
Sept.	12.75	11.25	14.00	15.50	32.50	29.00	24.50	42.75	17.00	21.75	21.00	18.00	18.50	17.50	15.50	15.88	16.50
Oct.	12.46	10.10	13.75	15.88	29.00	29.00	24.50	40.50	17.00	22.50	19.60	17.50	18.50	17.13	15.50	16.50	16.50
Nov.	12.00	9.50	14.05	18.88	31.25	29.00	27.75	36.40	17.20	20.50	17.75	17.88	18.50	16.60	15.50	16.50	15.75
Dec.	12.00	10.00	15.63	22.38	32.40	28.00	30.50	26.00	16.63	20.00	19.50	19.20	18.50	16.50	15.50	16.50	15.50
Aver.	*13.52*	*11.28*	*12.47*	*16.98*	*28.93*	*29.17*	*24.30*	*38.48*	*18.42*	*18.13*	*22.18*	*18.20*	*18.16*	*17.22*	*15.67*	*15.78*	*16.29*

Metals, Tin Plate and Galvanized Sheets for Sixteen Years

Copper at New York, Cents a Pound (Lake Copper through 1919; Electrolytic Copper, 1920 to Date)

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	16.98	14.85	14.02	24.39	29.73	23.50	20.48	19.27	12.95	13.55	14.52	12.46	14.73	13.84	12.99	13.85	16.59
Feb.	15.55	15.00	15.21	26.85	34.90	23.50	17.86	19.02	12.84	12.92	15.34	12.73	14.49	14.00	12.69	13.82	17.74
March	15.05	14.79	15.75	27.10	35.85	23.50	15.46	18.50	12.19	12.68	16.84	13.52	14.06	13.86	13.08	13.90	21.25
April	15.67	14.75	18.90	28.27	31.67	23.50	15.55	19.19	12.49	12.61	16.81	13.21	13.30	13.69	12.81	14.13	19.69
May	15.91	14.40	21.00	28.88	31.42	23.50	16.18	19.05	12.79	13.13	15.54	12.76	13.34	13.60	12.65	14.19	17.75
June	15.42	14.12	23.38	27.82	32.46	23.50	17.95	19.00	12.88	13.62	14.74	12.35	13.41	13.64	12.37	14.50	17.75
July	14.78	13.70	21.98	25.84	28.78	25.80	22.07	19.00	12.46	13.71	14.39	12.39	13.95	13.91	12.51	14.50	17.75
Aug.	15.86	12.85	19.33	26.95	27.24	26.00	23.16	19.00	11.70	13.74	13.87	13.26	14.48	14.19	13.00	14.50	17.75
Sept.	16.77	12.66	17.97	28.03	24.90	26.00	22.68	18.70	12.01	13.75	13.36	12.97	14.42	14.05	12.93	14.70	17.75
Oct.	16.85	11.73	17.89	28.48	23.50	26.00	22.13	16.56	12.67	13.66	12.58	12.96	14.29	13.88	13.98	15.16	17.75
Nov.	16.16	12.00	18.92	32.32	23.50	26.00	20.69	14.63	13.07	13.62	12.76	13.59	14.36	13.59	13.34	15.75	17.75
Dec.	14.88	13.35	20.24	33.38	23.50	25.40	18.90	13.63	13.55	14.00	12.88	14.23	13.82	13.31	13.79	15.84	17.75
Aver.	*15.82*	*13.68*	*18.72*	*28.19*	*28.95*	*24.68*	*19.42*	*17.96*	*12.63*	*13.42*	*14.47*	*13.04*	*14.05*	*13.80*	*12.93*	*14.57*	*18.11*

Spelter (Zinc) at New York, Cents a Pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	7.15	5.29	6.59	18.19	9.94	7.88	7.38	9.62	5.83	5.06	7.28	6.78	8.10	8.75	7.03	6.00	6.70
Feb.	6.45	5.40	8.84	20.13	10.48	7.99	6.70	9.14	5.36	4.85	7.58	7.11	7.86	8.16	7.04	5.90	6.70
March	6.26	5.28	9.29	18.40	10.77	7.64	6.52	8.93	5.20	5.00	8.19	6.85	7.68	7.69	7.06	5.98	6.80
April	5.77	5.18	11.22	18.58	9.85	7.01	6.51	8.63	5.24	5.25	7.65	6.49	7.35	7.36	6.69	6.11	7.04
May	5.47	5.06	16.14	15.86	9.46	7.32	6.46	8.08	5.28	5.45	6.99	6.13	7.30	7.16	6.43	6.37	6.98
June	5.18	5.09	22.18	12.75	9.62	8.01	6.93	7.92	4.95	5.69	6.40	6.14	7.35	7.47	6.57	6.50	7.00
July	5.38	5.02	20.58	9.83	8.95	8.69	7.90	8.18	4.77	6.12	6.43	6.25	7.60	7.76	6.58	6.55	7.10
Aug.	5.75	5.60	14.11	8.98	8.69	8.96	7.84	8.31	4.69	6.59	6.68	6.53	7.55	7.69	6.70	6.59	7.15
Sept.	5.82	5.50	14.16	8.22	8.34	9.60	7.57	7.82	4.74	6.91	6.81	6.54	8.12	7.76	6.56	6.60	7.15
Oct.	5.42	4.97	13.96	9.98	8.24	9.11	7.83	7.51	5.10	7.20	6.66	6.67	8.65	7.66	6.35	6.60	7.09
Nov.	5.29	5.12	17.15	11.90	7.95	8.70	8.14	6.84	5.18	7.48	6.70	7.14	9.04	7.56	6.09	6.62	6.63
Dec.	5.18	5.71	16.69	11.13	7.84	8.45	8.59	6.00	5.25	7.46	6.60	7.73	8.97	7.39	6.15	6.70	6.09
Aver.	*5.76*	*5.27*	*14.24*	*13.66*	*9.18*	*8.28*	*7.36*	*8.08*	*5.13*	*6.09*	*7.00*	*6.70*	*7.96*	*7.70*	*6.60*	*6.39*	*6.87*

Lead, at New York, Cents a Pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	4.35	4.11	3.74	5.93	7.69	6.87	5.56	8.67	5.00	4.70	7.85	8.31	10.26	9.25	7.59	6.50	6.65
Feb.	4.35	4.06	3.82	6.23	9.13	7.04	5.05	8.88	4.54	4.70	8.14	9.01	9.38	9.08	7.40	6.34	6.85
March	4.35	3.97	4.04	7.43	9.47	7.24	5.23	9.21	4.08	4.71	8.47	9.23	8.90	8.46	7.57	6.00	7.41
April	4.40	3.82	4.20	7.73	9.43	6.95	5.03	8.95	4.33	5.13	8.19	8.19	8.01	7.91	7.10	6.10	7.19
May	4.37	3.90	4.25	7.45	11.00	6.88	5.05	8.55	4.99	5.51	7.39	7.27	8.08	7.75	6.60	6.13	7.00
June	4.35	3.90	5.89	6.87	11.68	7.55	5.34	8.48	4.56	5.73	7.14	7.08	8.35	8.08	6.42	6.30	7.00
July	4.37	3.90	5.59	6.34	10.72	8.04	5.65	8.67	4.40	5.75	6.28	7.15	8.33	8.60	6.33	6.22	6.80
Aug.	4.64	3.87	4.68	6.26	10.72	8.05	5.77	8.98	4.40	5.88	6.74	8.02	9.52	8.96	6.69	6.25	6.75
Sept.	4.73	3.86	4.62	6.88	8.84	8.05	6.12	8.11	4.60	6.20	7.06	8.09	9.60	8.80	6.30	6.45	6.88
Oct.	4.52	3.52	4.60	7.00	6.77	8.05	6.45	7.24	4.70	6.67	6.84	8.31	9.62	8.40	6.25	6.50	6.87
Nov.	4.33	3.68	5.16	7.13	6.44	8.05	6.76	6.33	4.70	7.20	6.87	8.96	9.34	8.00	6.27	6.39	6.29
Dec.	4.06	3.80	5.33	7.60	6.48	6.71	7.03	4.80	4.70	7.28	7.61	9.61	9.36	7.87	6.52	6.49	6.25
Aver.	*4.40*	*3.87*	*4.66*	*6.90*	*9.03*	*7.46*	*5.76*	*8.07*	*4.58*	*5.79*	*7.39*	*8.27*	*9.10*	*8.39*	*6.75*	*6.31*	*6.83*

Straits Tin, at New York, Cents a Pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	50.34	39.12	34.13	41.76	44.10	85.13	71.50	62.74	35.94	32.03	39.16	48.70	58.26	62.20	66.43	55.56	49.21
Feb.	48.71	39.82	37.25	42.60	51.47	85.00	72.45	59.87	32.16	30.74	41.98	53.41	57.09	63.65	69.05	52.47	49.39
March	46.93	38.03	48.73	50.53	58.38	85.00	72.50	61.93	28.79	29.14	48.61	55.03	53.67	64.47	69.23	52.11	48.85
April	49.04	36.10	47.64	51.51	55.82	88.53	72.50	62.12	30.36	30.58	45.84	50.02	52.27	63.35	67.88	52.28	45.93
May	49.06	33.21	38.79	49.14	63.21	100.00	72.50	54.99	32.50	30.92	43.11	44.08	54.65	62.36	67.47	51.53	43.88
June	45.01	30.60	40.26	42.07	61.93	91.00	71.83	48.34	29.39	31.46	40.97	42.74	55.93	60.63	67.42	47.92	44.20
July	41.32	35.65	37.38	38.25	61.61	93.00	70.11	49.29	27.69	31.67	38.47	46.29	58.05	62.98	64.01	47.01	46.29
Aug.	41.63	48.34	34.37	38.88	62.53	91.33	62.20	47.60	26.35	32.36	39.33	51.89	58.12	65.17	64.41	47.97	46.60
Sept.	42.63	31.13	33.13	38.65	61.54	80.40	59.79	44.43	26.70	32.36	41.60	49.24	58.27	68.89	61.43	48.06	45.32
Oct.	40.38	30.25	33.05	41.10	62.24	78.82	54.82	40.47	27.70	34.61	41.80	50.60	62.24	70.36	58.49	48.99	42.25
Nov.	39.75	33.28	39.50	44.12	74.18	73.67	54.17	36.97	28.93	36.76	44.09	54.25	63.30	70.75	57.49	50.76	40.18
Dec.	37.12	34.01	38.53	42.55	84.74	71.51	53.80	34.04	32.41	37.48	47.16	56.03	62.94	68.68	58.54	50.23	39.87
Aver.	*44.33*	*35.80*	*38.56*	*43.43*	*61.90*	*85.28*	*65.68*	*50.23*	*29.91*	*32.51*	*42.68*	*50.19*	*57.90*	*64.29*	*64.32*	*50.39*	*45.16*

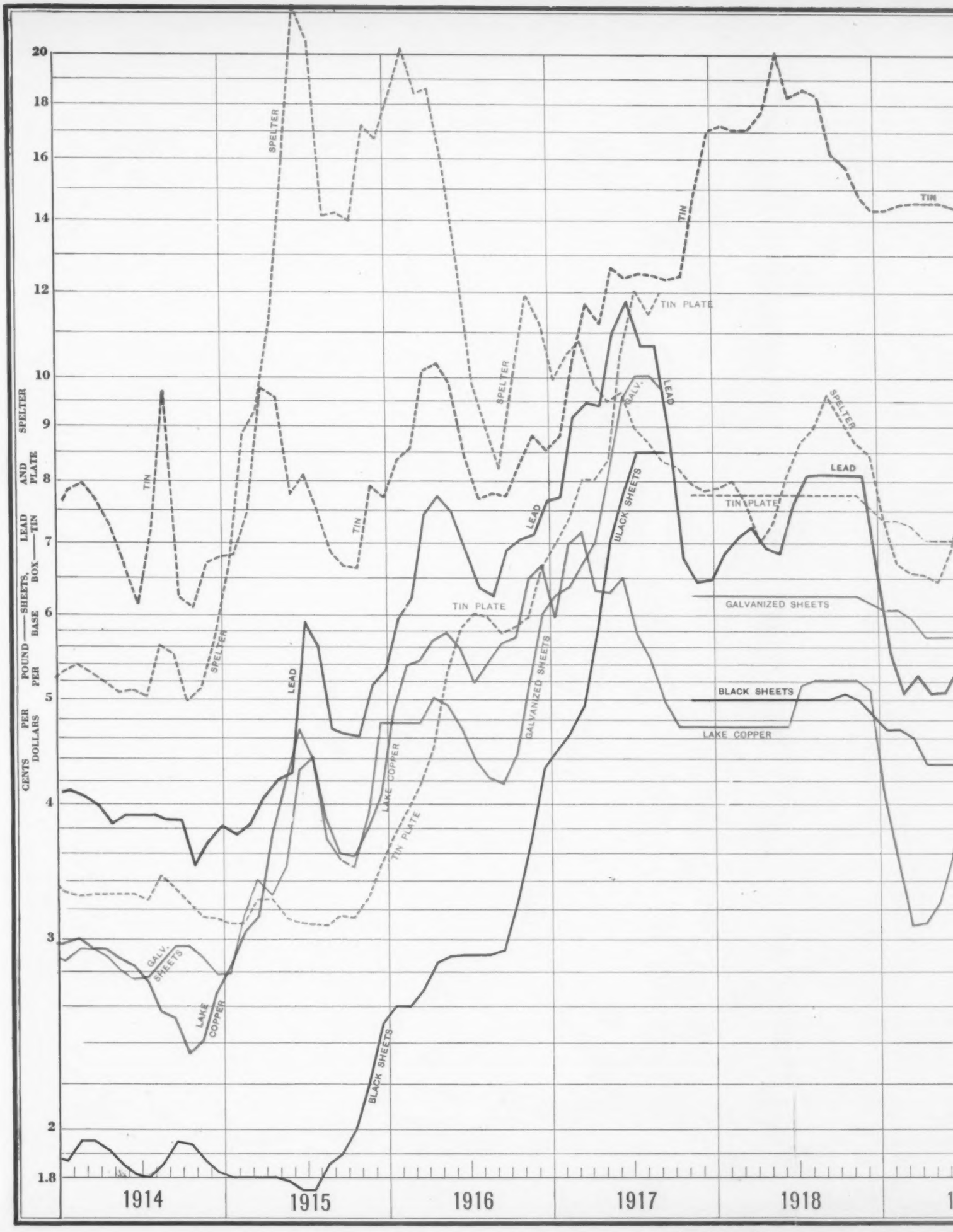
Tin Plate, at Pittsburgh, Dollars a Base Box

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$3.60	$3.32	$3.10	$3.75	$7.00	$7.75	$7.35	$7.00	$7.00	$4.75	$4.75	$5.50	$5.50	$5.50	$5.50	$5.25	$5.35
Feb.	3.60	3.29	3.10	3.96	7.38	7.75	7.35	7.00	7.00	4.71	4.80	5.50	5.50	5.50	5.50	5.25	5.35
March	3.60	3.30	3.25	4.19	8.00	7.75	7.26	7.00	7.00	4.60	5.23	5.50	5.50	5.50	5.50	5.25	5.35
April	3.60	3.30	3.25	4.50	8.00	7.75	7.00	7.00	6.44	4.75	6.00	5.50	5.50	5.50	5.50	5.25	5.35
May	3.60	3.30	3.15	5.30	8.40	7.75	7.00	7.00	6.25	4.75	5.70	5.50	5.50	5.50	5.50	5.25	5.35
June	3.60	3.30	3.11	5.81	10.50	7.75	7.00	7.00	6.25	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
July	3.60	3.27	3.10	6.00	12.00	7.75	7.00	7.50	5.69	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Aug.	3.55	3.41	3.10	5.95	11.40	7.75	7.00	9.00	5.25	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Sept.	3.50	3.35	3.15	5.75	12.00	7.75	7.00	9.00	5.25	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Oct.	3.50	3.24	3.15	5.81	....	7.75	7.00	8.33	5.12	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Nov.	3.40	3.15	3.28	5.97	7.75	7.75	7.00	7.50	4.75	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Dec.	3.40	3.13	3.52	6.63	7.75	7.55	7.00	7.00	4.73	4.75	5.50	5.50	5.50	5.50	5.25	5.25	5.35
Aver.	*3.55*	*3.28*	*3.19*	*5.30*	*9.11*	*7.73*	*7.08*	*7.53*	*5.90*	*4.73*	*5.42*	*5.50*	*5.50*	*5.50*	*5.48*	*5.25*	*5.35*

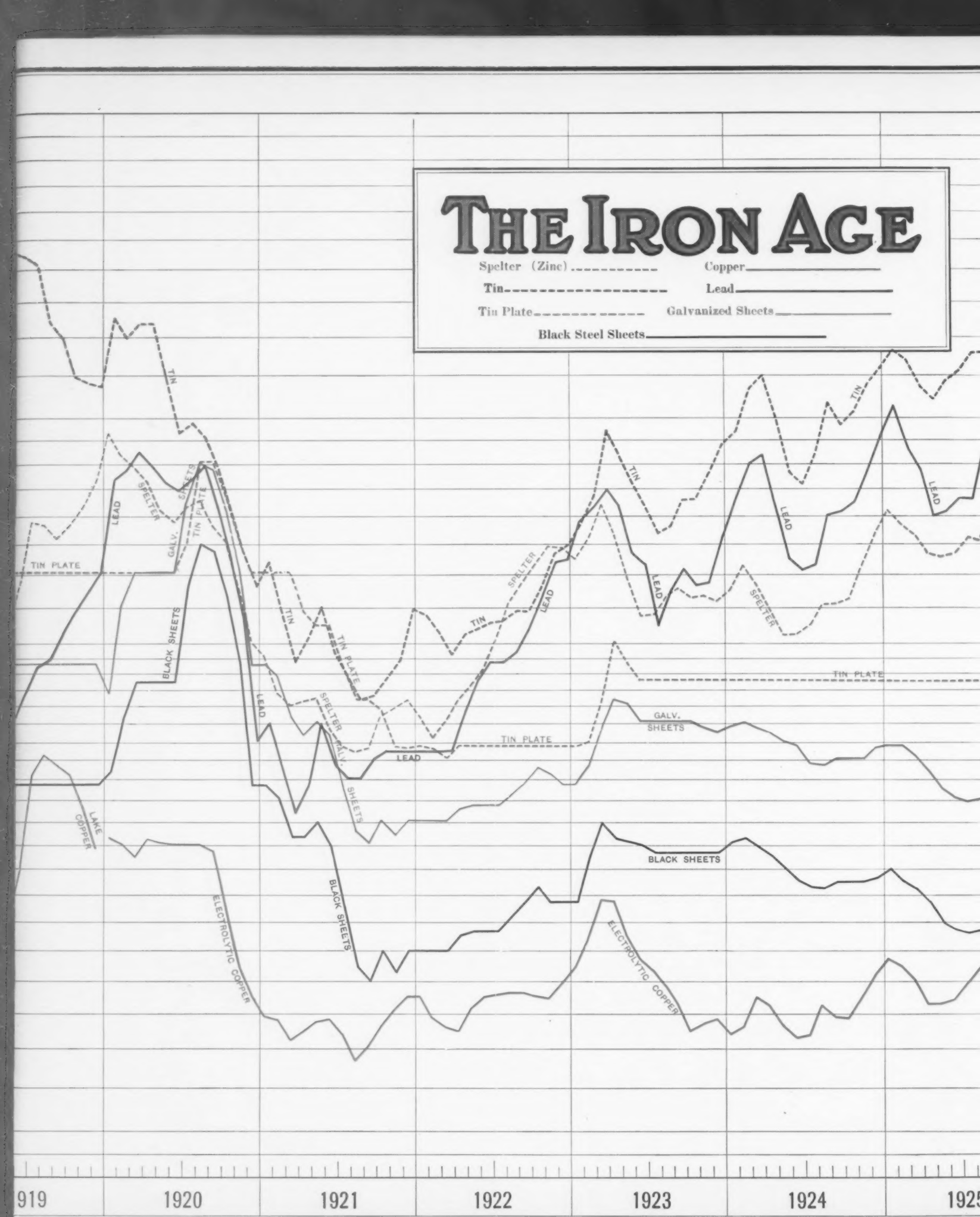
No. 28 Gage Galvanized Sheets, at Pittsburgh, Cents a Pound

(While No. 24 gage was made the base in 1926, this table has been continued at No. 28 gage, to preserve comparisons with past years.)

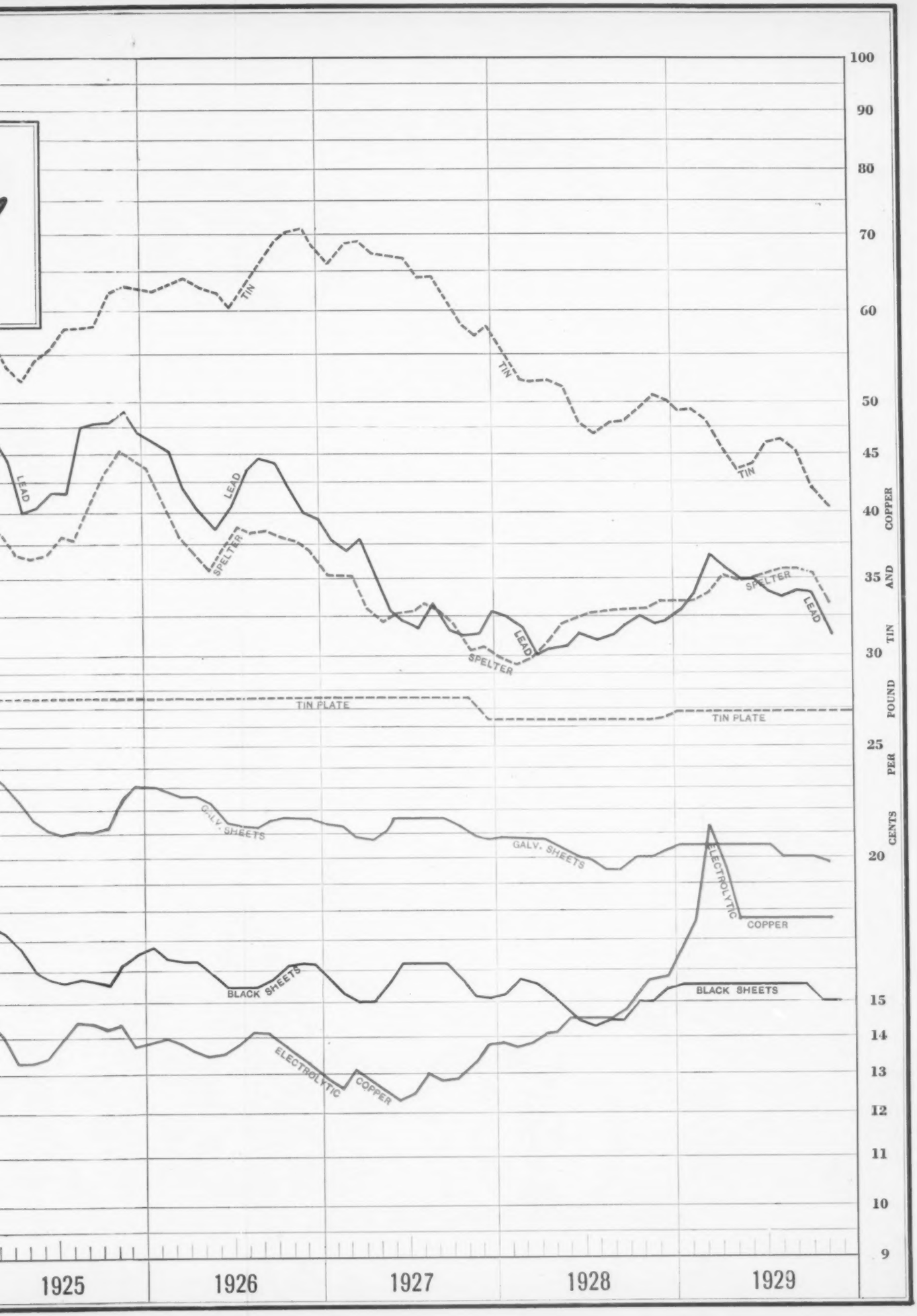
	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	3.46	2.87	2.79	4.75	6.25	6.25	6.05	5.33	5.70	4.00	4.35	4.98	4.75	4.60	4.28	4.15	4.10
Feb.	3.50	2.95	3.16	4.75	6.38	6.25	6.05	6.50	5.56	4.00	4.54	5.00	4.75	4.53	4.21	4.15	4.10
March	3.50	2.95	3.40	4.75	6.69	6.25	5.96	7.00	5.05	4.00	4.93	4.93	4.62	4.50	4.15	4.15	4.10
April	3.50	2.91	3.29	5.00	7.00	6.25	5.70	7.00	4.88	4.11	5.25	4.88	4.45	4.50	4.13	4.15	4.10
May	3.42	2.80	3.50	4.94	8.20	6.25	5.70	7.00	5.00	4.15	5.20	4.80	4.29	4.43	4.22	4.08	4.10
June	3.38	2.75	4.28	4.69	9.50	6.25	5.70	7.00	4.88	4.15	5.00	4.76	4.21	4.28	4.35	4.00	4.10
July	3.33	2.75	4.40	4.38	10.00	6.25	5.70	8.25	4.31	4.15	5.00	4.56	4.19	4.24	4.35	3.96	4.10
Aug.	3.24	2.85	3.71	4.21	10.00	6.25	5.70	9.00	3.90	4.23	5.00	5.55	4.20	4.23	4.35	3.90	4.00
Sept.	3.16	2.95	3.56	4.18	9.75	6.25	5.70	8.88	3.81	4.35	5.00	4.60	4.20	4.33	4.35	3.90	4.00
Oct.	3.08	2.95	3.50	4.41	....	6.25	5.70	8.18	4.00	4.50	5.00	4.60	4.23	4.35	4.26	4.00	4.00
Nov.	3.98	2.88	3.89	5.18	6.25	6.25	5.70	7.04	3.86	4.43	4.93	4.60	4.50	4.35	4.16	4.00	3.98
Dec.	2.90	2.78	4.75	6.00	6.25	6.15	5.70	5.70	4.00	4.35	4.89	4.72	4.80	4.35	4.13	4.08	3.90
Aver.	*3.29*	*2.87*	*3.69*	*4.77*	*7.84*	*6.24*	*5.78*	*7.24*	*4.58*	*4.20*	*4.92*	*4.75*	*4.42*	*4.39*	*4.25*	*4.04*	*4.05*



Carload Prices of Copper



, Lead, Tin and Zinc in New York, and of Tin Plate and Black and Galvanized Sheets in



ets in Pittsburgh

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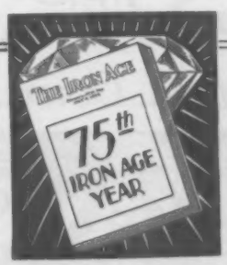
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THE IRON AGE

New York, January 9, 1930

ESTABLISHED 1855 VOL. 125, No. 2

Molybdenum Steels Gaining Favor

Survey of Present Applications Shows a Large Tonnage Being Absorbed in Heat Treated Steel Parts and Case-Hardened Pieces Requiring Maximum Toughness and Uniformity

BY E. E. THUM

WHILE molybdenum alloy steels were made toward the middle of the last century, the rarity of the element prevented a systematic study of their characteristics and their commercial development. During the Great War a sudden demand for the metal arose, the price bounded up, and intensive prospecting for mineral deposits disclosed several in the western States. Thus it has developed that the "rare element" molybdenum is in reality available in any quantity, after the necessary time had elapsed in order to develop the mines and to build the reduction plants.

This changed situation encouraged an investigation of the utility of molybdenum in structural or engineering steels. These researches led to a conclusion which has since been verified by practical experience, namely, that molybdenum is most valuable when less than 1 per cent is added to steels containing other common alloying elements, such as nickel and chromium. It was immediately apparent that such combinations had superior resistance to shock and sudden load.

About 250,000 tons of steel containing molybdenum is used annually. Case-hardened pieces (either by carburization or nitriding) such as

Roller bearings
Gears
Camshafts
Wrist pins

consume a considerable fraction of the tonnage. Parts to carry high stress, such as

Axles
Connecting rods
Steering spindles
Aircraft fuselages

are made of the heat treated alloys. Large objects, requiring extra toughness and uniformity, like

Crankshafts
Hammer rams
Die blocks
Gun tubes
Armor plate

are made of these steels, together with other items such as

Corrosion resistant sheets
Soft steel for deep pressing
Hand tools

While higher molybdenum alloys had been made commercially by the crucible process many years before, the first electric furnace heat of low molybdenum steel was made in December, 1917; open-hearth production started in May, 1918, both events taking place at United Alloy Steel Corporation, Canton, Ohio. Use of the steel during war times was confined to those parts where the maximum toughness was required, namely, light armor for helmets and tank armor, armor piercing projectiles, and Liberty motor crankshafts. Uses since the war, which have so largely increased the tonnage, have been due to the more complex combination of properties listed below, to exploitation by producers of the metal, and marked reduction in price.

Molybdenum is marketed as ferromolybdenum, calcium molybdate, or calcium-molybdenum silicate; at least 250,000 tons of the low alloy steel now popular was made in 1928 in the United States. American mines monopolize the situation; the 1918 price of $5 has steadily declined to about one-fifth that figure.

Effect of Adding Molybdenum to Alloy Steel

Experience has developed the following facts about alloy steels containing a little molybdenum:

(a) The most prominent and unmistakable is an ability to induce air hardening and hardening at depth. A massive piece of such an alloy steel will be hard even at the center (where it cools comparatively slowly no matter how rapidly the surface is cooled); furthermore, moderate sized pieces harden effectively when cooled in air.

(b) Quenched alloy steels containing molybdenum hold their hardness after higher drawing temperatures. Longer times at heat are also required to complete the proper reactions; a sluggish rate of grain growth also prevents coarsened, brittle structures after relatively long heatings.

Metals, Tin Plate and Galvanized Sheets for Sixteen Years

Copper at New York, Cents a Pound (Lake Copper through 1919; Electrolytic Copper, 1920 to Date)

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	16.98	14.85	14.02	24.39	29.73	23.50	20.48	19.27	12.95	13.55	14.52	12.46	14.73	13.84	12.99	13.85	16.59
Feb.	15.55	15.00	15.21	26.85	34.90	23.50	17.86	19.02	12.84	12.92	15.34	12.73	14.49	14.00	12.69	13.82	17.74
March	15.05	14.79	15.75	27.10	35.85	23.50	15.46	18.50	12.19	12.68	16.84	13.52	14.06	13.86	13.08	13.90	21.25
April	15.67	14.75	18.90	28.27	31.67	23.50	15.55	19.19	12.49	12.61	16.81	13.21	13.30	13.69	12.81	14.13	19.69
May	15.91	14.40	21.00	28.88	31.42	23.50	16.18	19.05	12.79	13.13	15.54	12.76	13.34	13.60	12.65	14.19	17.75
June	15.42	14.12	23.38	27.82	32.46	23.50	17.95	19.00	12.88	13.62	14.74	12.35	13.41	13.64	12.37	14.50	17.75
July	14.78	13.70	21.98	25.84	28.78	25.80	22.07	19.00	12.46	13.71	14.39	12.39	13.95	13.91	12.51	14.50	17.75
Aug.	15.86	12.85	19.33	26.95	27.24	26.00	23.16	19.00	11.70	13.74	13.87	13.26	14.48	14.19	13.00	14.50	17.75
Sept.	16.77	12.66	17.97	28.03	24.90	26.00	22.68	18.70	12.01	13.75	13.36	12.97	14.42	14.05	12.93	14.70	17.75
Oct.	16.85	11.73	17.89	28.48	23.50	26.00	22.13	16.56	12.67	13.66	12.58	12.96	14.29	13.88	12.98	15.16	17.75
Nov.	16.16	12.00	18.92	32.32	23.50	26.00	20.69	14.63	13.07	13.62	12.76	13.59	14.36	13.59	13.34	15.75	17.75
Dec.	14.88	13.35	20.24	33.38	23.50	25.40	18.90	13.63	13.55	14.00	12.88	14.23	13.82	13.31	13.79	15.84	17.75
Aver.	*15.82*	*13.68*	*18.72*	*28.19*	*28.95*	*24.68*	*19.43*	*17.96*	*12.63*	*13.42*	*14.47*	*13.04*	*14.05*	*13.80*	*12.93*	*14.57*	*18.11*

Spelter (Zinc) at New York, Cents a Pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	7.15	5.29	6.59	18.19	9.94	7.88	7.38	9.62	5.83	5.06	7.28	6.78	8.10	8.75	7.03	6.00	6.70
Feb.	6.45	5.40	8.84	20.13	10.48	7.89	6.70	9.14	5.36	4.85	7.58	7.11	7.86	8.16	7.04	5.90	6.70
March	6.26	5.28	9.29	18.40	10.77	7.64	6.52	8.93	5.20	5.00	8.19	6.85	7.68	7.69	7.06	5.98	6.80
April	5.77	5.18	11.22	18.58	9.85	7.01	6.51	8.63	5.24	5.25	7.65	6.49	7.35	7.36	6.69	6.11	7.04
May	5.47	5.06	16.14	15.86	9.46	7.32	6.46	8.08	5.28	5.45	6.99	6.13	7.30	7.16	6.43	6.37	6.98
June	5.18	5.09	22.18	12.75	9.62	8.01	6.93	7.92	4.95	5.69	6.40	6.14	7.35	7.47	6.57	6.50	7.00
July	5.38	5.02	20.58	9.83	8.95	8.69	7.90	8.18	4.77	6.12	6.43	6.25	7.60	7.76	6.58	6.55	7.10
Aug.	5.75	5.60	14.11	8.98	8.69	8.96	7.84	8.31	4.69	6.59	6.68	6.53	7.55	7.69	6.70	6.59	7.15
Sept.	5.82	5.50	14.16	8.22	8.34	9.60	7.57	7.82	4.74	6.91	6.81	6.54	8.12	7.76	6.56	6.60	7.15
Oct.	5.42	4.97	13.96	9.98	8.24	9.11	7.83	7.51	5.10	7.20	6.66	6.67	8.65	7.66	6.35	6.60	7.09
Nov.	5.29	5.12	17.15	11.90	7.95	8.70	8.14	6.84	5.18	7.48	6.70	7.14	9.04	7.56	6.09	6.62	6.63
Dec.	5.18	5.71	16.69	11.13	7.84	8.45	8.59	6.00	5.25	7.46	6.60	7.73	8.97	7.39	6.15	6.70	6.09
Aver.	*5.76*	*5.27*	*14.24*	*13.66*	*9.18*	*8.28*	*7.36*	*8.08*	*5.13*	*6.09*	*7.00*	*6.70*	*7.96*	*7.70*	*6.60*	*6.39*	*6.87*

Lead, at New York, Cents a Pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	4.35	4.11	3.74	5.93	7.69	6.87	5.56	8.67	5.00	4.70	7.85	8.31	10.26	9.25	7.59	6.50	6.65
Feb.	4.35	4.06	3.82	6.23	9.13	7.04	5.05	8.88	4.54	4.70	8.14	9.01	9.38	9.08	7.40	6.34	6.85
March	4.35	3.97	4.04	7.43	9.47	7.24	5.23	9.21	4.08	4.71	8.47	9.23	8.90	8.46	7.57	6.00	7.41
April	4.40	3.82	4.20	7.73	9.43	6.95	5.03	8.95	4.33	5.13	8.19	8.19	8.01	7.91	7.10	6.10	7.19
May	4.37	3.90	4.25	7.45	11.00	6.88	5.05	8.55	4.99	5.51	7.39	7.27	8.08	7.75	6.60	6.13	7.00
June	4.35	3.90	5.89	6.87	11.68	7.55	5.34	8.48	4.56	5.73	7.14	7.08	8.35	8.08	6.42	6.30	7.00
July	4.37	3.90	5.59	6.34	10.72	8.04	5.65	8.67	4.40	5.75	6.28	7.15	8.33	8.60	6.33	6.22	6.80
Aug.	4.64	3.87	4.68	6.26	10.72	8.05	5.77	8.98	4.40	5.88	6.74	8.02	9.52	8.96	6.69	6.25	6.75
Sept.	4.73	3.86	4.62	6.88	8.84	8.05	6.12	8.11	4.60	6.20	7.06	8.09	9.60	8.80	6.30	6.45	6.88
Oct.	4.52	3.52	4.60	7.00	6.77	8.05	6.45	7.24	4.70	6.67	6.84	8.31	9.62	8.40	6.25	6.50	6.87
Nov.	4.33	3.68	5.16	7.13	6.44	8.05	6.76	6.33	4.70	7.20	6.87	8.96	9.84	8.00	6.27	6.39	6.29
Dec.	4.06	3.80	5.33	7.60	6.48	6.71	7.03	4.80	4.70	7.28	7.61	9.61	9.36	7.87	6.52	6.49	6.25
Aver.	*4.40*	*3.87*	*4.66*	*6.90*	*9.03*	*7.46*	*5.76*	*8.07*	*4.58*	*5.79*	*7.39*	*8.27*	*9.10*	*8.39*	*6.75*	*6.31*	*6.83*

Straits Tin, at New York, Cents a Pound

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	50.34	39.12	34.13	41.76	44.10	85.13	71.50	62.74	35.94	32.03	39.16	48.70	58.26	62.20	66.43	55.56	49.21
Feb.	48.71	39.82	37.25	42.60	51.47	85.00	72.45	59.87	32.16	30.74	41.98	53.41	57.09	63.65	69.05	52.47	49.39
March	46.93	38.03	48.73	50.53	58.38	85.00	72.50	61.93	28.79	29.14	48.61	55.03	53.67	64.47	69.23	52.11	48.85
April	49.04	36.10	47.64	51.51	55.82	88.53	72.50	62.12	30.36	30.58	45.84	50.02	52.27	63.35	67.88	52.28	45.93
May	49.06	33.21	38.79	49.14	63.21	100.00	72.50	54.99	32.50	30.92	43.11	44.08	54.65	62.36	67.47	51.53	43.88
June	45.01	30.60	40.26	42.07	61.93	91.00	71.83	48.34	29.39	31.46	40.97	42.74	55.93	60.63	67.42	47.92	44.20
July	41.32	35.65	37.38	38.25	61.61	93.00	70.11	49.29	27.69	31.67	38.47	46.29	58.05	62.98	64.01	47.01	46.29
Aug.	41.63	48.34	34.37	38.88	62.53	81.33	62.20	47.60	26.35	32.36	39.33	51.89	58.12	65.17	64.41	47.97	46.60
Sept.	42.63	31.13	33.13	38.65	61.54	80.40	59.79	44.43	26.70	32.36	41.60	49.24	58.27	68.89	61.43	48.06	45.32
Oct.	40.38	30.25	33.05	41.10	62.24	78.82	54.82	40.47	27.70	34.61	41.80	50.60	62.24	70.36	58.49	48.99	42.25
Nov.	39.75	33.28	39.50	44.12	74.18	73.67	54.17	36.97	28.93	36.76	44.09	54.25	63.30	70.75	57.49	50.76	40.18
Dec.	37.12	34.01	38.53	42.55	84.74	71.51	53.80	34.04	32.41	37.48	47.16	56.03	62.94	68.68	58.54	50.23	39.87
Aver.	*44.33*	*35.80*	*38.56*	*43.43*	*61.90*	*85.28*	*65.68*	*50.23*	*29.91*	*32.51*	*42.68*	*50.19*	*57.90*	*64.29*	*64.32*	*50.39*	*45.16*

Tin Plate, at Pittsburgh, Dollars a Base Box

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	$3.60	$3.32	$3.10	$3.75	$7.00	$7.75	$7.35	$7.00	$7.00	$4.75	$4.75	$5.50	$5.50	$5.50	$5.50	$5.25	$5.35
Feb.	3.60	3.29	3.10	3.96	7.38	7.75	7.35	7.00	7.00	4.71	4.80	5.50	5.50	5.50	5.50	5.25	5.35
March	3.60	3.30	3.25	4.19	8.00	7.75	7.26	7.00	7.00	4.60	5.23	5.50	5.50	5.50	5.50	5.25	5.35
April	3.60	3.30	3.25	4.50	8.00	7.75	7.00	7.00	6.44	4.75	6.00	5.50	5.50	5.50	5.50	5.25	5.35
May	3.60	3.30	3.15	5.30	8.40	7.75	7.00	7.00	6.25	4.75	5.70	5.50	5.50	5.50	5.50	5.25	5.35
June	3.60	3.30	3.11	5.81	10.50	7.75	7.00	7.00	6.25	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
July	3.60	3.27	3.10	6.00	12.00	7.75	7.00	7.50	5.69	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Aug.	3.55	3.41	3.10	5.95	11.40	7.75	7.00	9.00	5.25	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Sept.	3.50	3.35	3.15	5.75	12.00	7.75	7.00	9.00	5.25	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Oct.	3.50	3.24	3.15	5.81	....	7.75	7.00	8.33	5.13	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Nov.	3.40	3.15	3.28	5.97	7.75	7.75	7.00	7.50	4.75	4.75	5.50	5.50	5.50	5.50	5.50	5.25	5.35
Dec.	3.40	3.13	3.52	6.63	7.75	7.75	7.00	7.00	4.73	4.75	5.50	5.50	5.50	5.50	5.25	5.25	5.35
Aver.	*3.55*	*3.28*	*3.19*	*5.30*	*9.11*	*7.73*	*7.08*	*7.53*	*5.90*	*4.73*	*5.42*	*5.50*	*5.50*	*5.50*	*5.48*	*5.25*	*5.35*

No. 28 Gage Galvanized Sheets, at Pittsburgh, Cents a Pound

(While No. 24 gage was made the base in 1926, this table has been continued at No. 28 gage, to preserve comparisons with past years.)

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Jan.	3.46	2.87	2.78	4.75	6.25	6.25	6.05	5.33	5.70	4.00	4.35	4.98	4.75	4.60	4.28	4.15	4.10
Feb.	3.50	2.95	3.16	4.75	6.38	6.25	6.05	6.50	5.56	4.00	4.54	5.00	4.75	4.53	4.21	4.15	4.10
March	3.50	2.95	3.40	4.75	6.69	6.25	5.96	7.00	5.05	4.00	4.93	4.93	4.62	4.50	4.15	4.15	4.10
April	3.50	2.91	3.29	5.00	7.00	6.25	5.70	7.00	4.88	4.11	5.25	4.88	4.45	4.50	4.13	4.15	4.10
May	3.42	2.80	3.50	4.94	8.20	6.25	5.70	7.00	5.00	4.15	5.20	4.80	4.29	4.43	4.22	4.08	4.10
June	3.38	2.75	4.28	4.69	9.50	6.25	5.70	7.00	4.88	4.15	5.00	4.76	4.21	4.28	4.35	4.00	4.10
July	3.33	2.75	4.40	4.38	10.00	6.25	5.70	8.25	4.31	4.15	5.00	4.56	4.19	4.24	4.35	3.96	4.10
Aug.	3.24	2.85	3.71	4.21	10.00	6.25	5.70	9.00	3.90	4.23	5.00	5.55	4.20	4.23	4.35	3.90	4.00
Sept.	3.16	2.95	3.56	4.18	9.75	6.25	5.70	8.88	3.81	4.35	5.00	4.60	4.20	4.33	4.35	3.90	4.00
Oct.	3.08	2.95	3.50	4.41	....	6.25	5.70	8.18	4.00	4.50	5.00	4.60	4.23	4.35	4.26	4.00	4.00
Nov.	2.98	2.88	3.89	5.18	6.25	6.25	5.70	7.04	3.86	4.43	4.93	4.60	4.50	4.35	4.16	4.00	3.98
Dec.	2.90	2.78	4.75	6.00	6.25	6.15	5.70	5.70	4.00	4.35	4.89	4.72	4.60	4.35	4.13	4.08	3.90
Aver.	*3.29*	*2.87*	*3.69*	*4.77*	*7.84*	*6.24*	*5.78*	*7.24*	*4.58*	*4.20*	*4.92*	*4.75*	*4.42*	*4.39*	*4.25*	*4.04*	*4.05*

CENTS DOLLARS	PER DOLLARS	POUND PER	SHEETS, BASE BOX	LEAD TIN	AND PLATE	SPELTER
20						
18						
16						
14						
12						
						10
						9
					8	
				7		
			6			
		5				
4						
	3					
2						
1.8						



MULT-AU-MATICS

Pay Generous Returns on Your Investment—

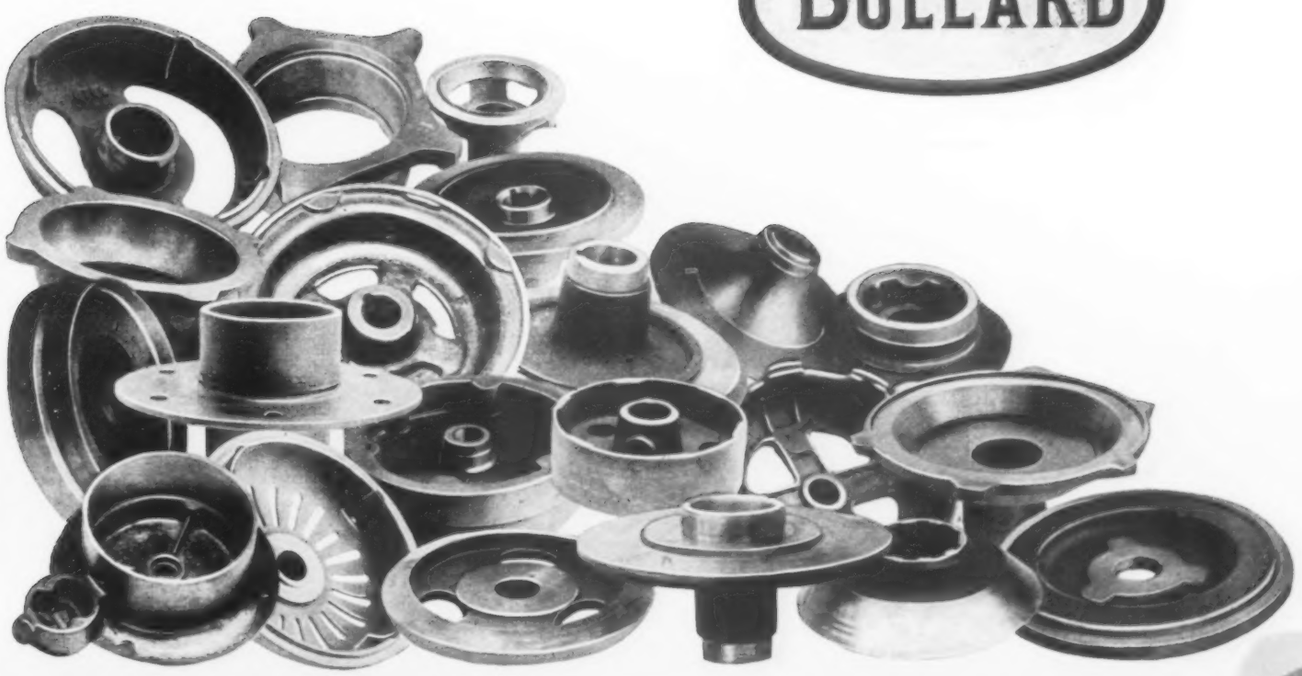
Bullards have been accepted almost universally as the key production unit on all kinds of chucking work such as transmission cases, clutch hubs, timing gear blanks, driving shaft flanges, brake drum hubs, differential parts, wheel hubs, universal joints, motor end plates, sprockets and hundreds of other pieces.

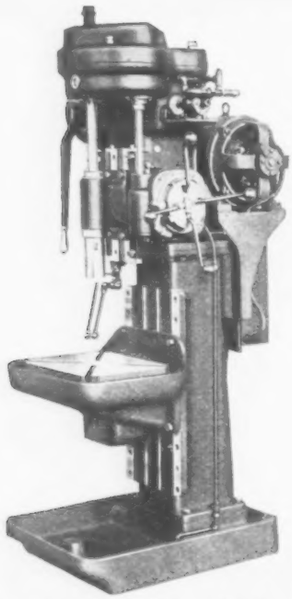
This acceptance is due to their ability to pay such a generous return on the money invested. These returns come thru in the form of savings, in floorspace, in number of operators, in material handling and in non-productive chucking time.

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The Bullard Machine Tool Company
Bridgeport, Conn.

BULLARD



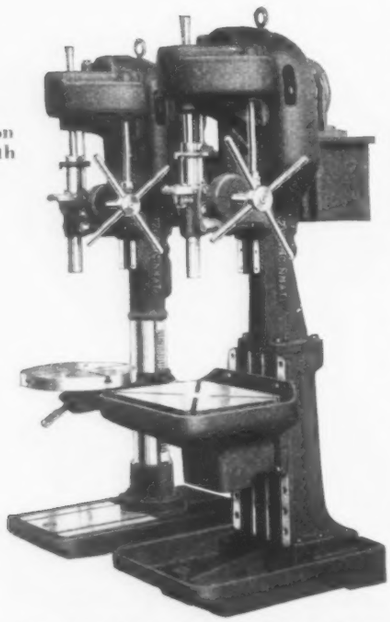


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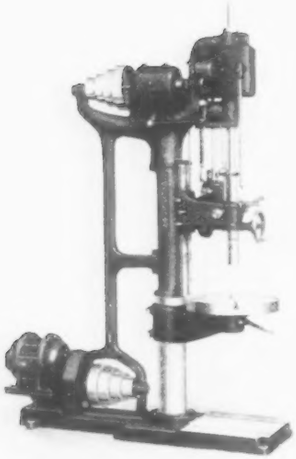
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Modern Drilling Machines Backed by 55 years of experience

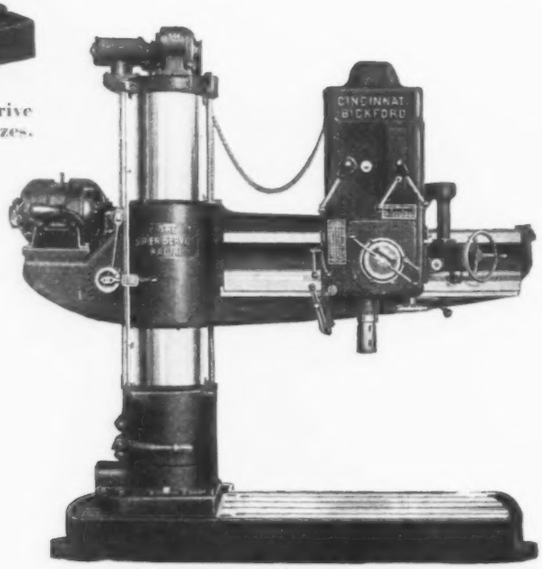
No matter what your drilling requirements, whether high production or small quantities, you can save drilling time and money by installing a Cincinnati Bickford drill. Many years of specializing on metal drilling machinery qualifies us to help you in selecting the proper drilling machine for your work. Send prints for our recommendations.



Round and Box Column Direct Drive Uprights—Built in 21" and 24" Sizes. —And Gang Drills of all Types.



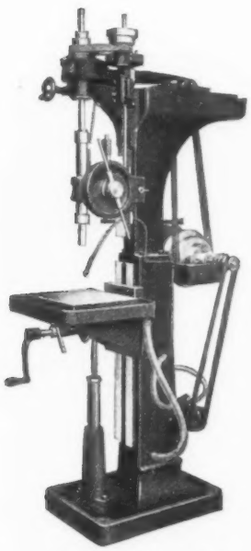
24" Cone Type Upright with tapping attachment and geared motor drive. Cone type drills are built in 20", 21", 24", 28" and 32" sizes.



THE SUPER SERVICE RADIAL
3 Ft. to 8 Ft. Sizes. Centralized Control
Write for detailed information.

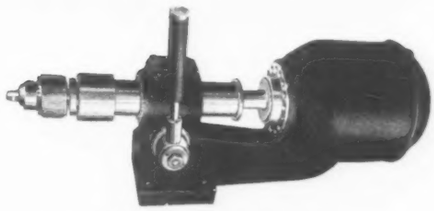
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OAKLEY, CINCINNATI, OHIO



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High-speed ball bearing sensitive drilling machine built in types from one to six spindles.



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High-speed ball-bearing drilling units of compact and rigid design. Can be mounted in any position on any machine to drill in connection with another operation—and save handling and set ups.

HIGH PRODUCTION
VIBRATION-FREE
EXTREMELY ACCURATE

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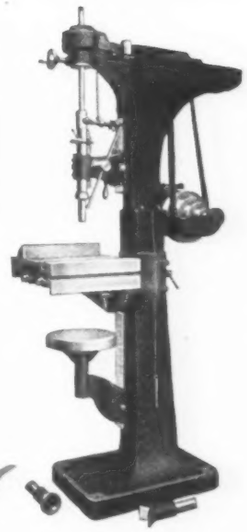
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Ball bearing throughout, they maintain high speeds continuously on heavy schedules—free from vibration and give the greatest possible accuracy and durability.

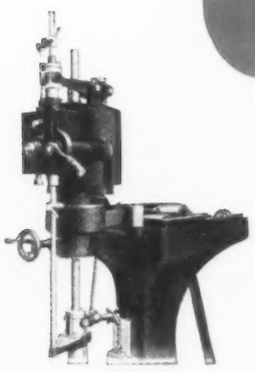
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CINCINNATI, OHIO



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Built for special tool room work, furnished with two tables, cup and V-centers.



AVEY NO. 2 TAPPING UNIT

Designed as a unit of the regular No. 2 AVEY Drilling Machine.



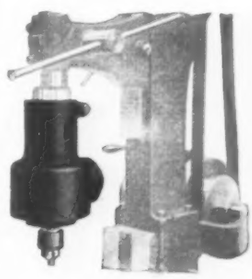
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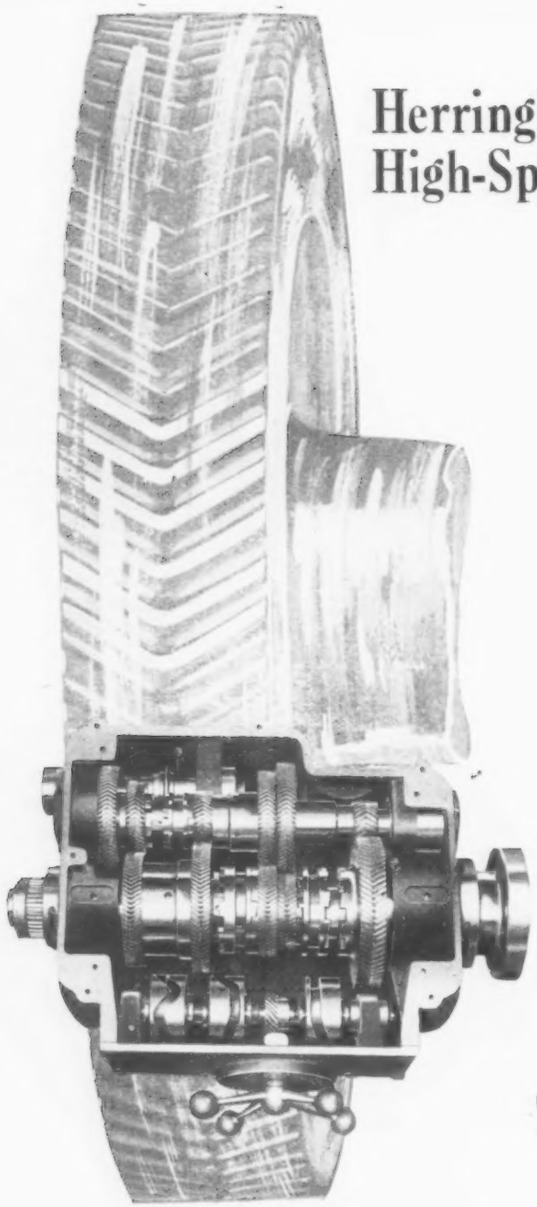
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Herringbone Gears Constantly Guard High-Speed Efficiency on MONOTROL

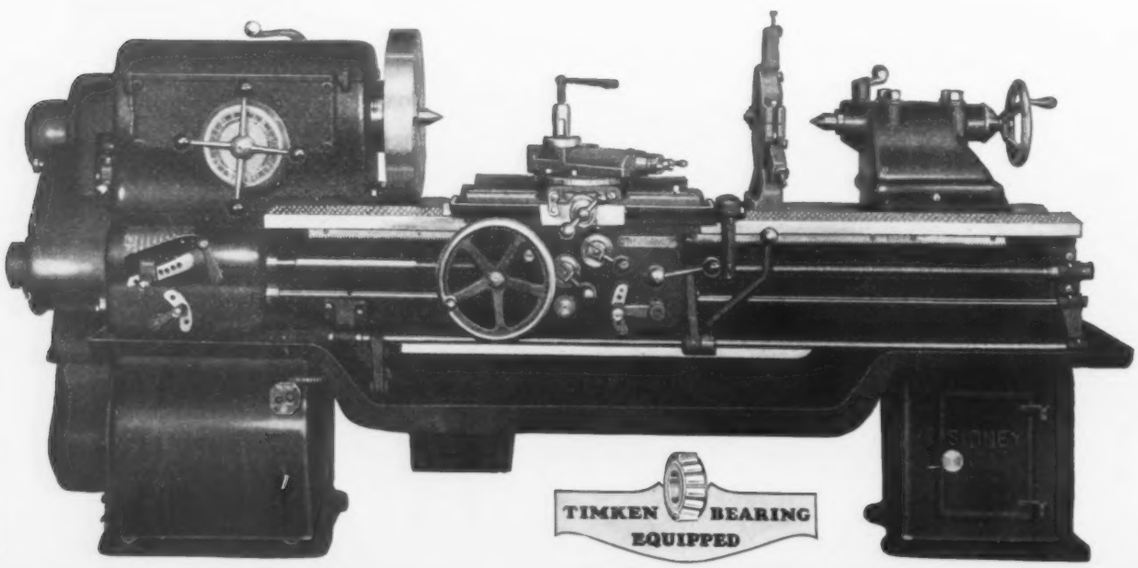
There can never be stripped gears in a Monotrol lathe . . . nor chatter marks to mar the job . . . for continuous tooth type Herringbone Gears, always in mesh, protect the efficiency of Monotrol at every speed.

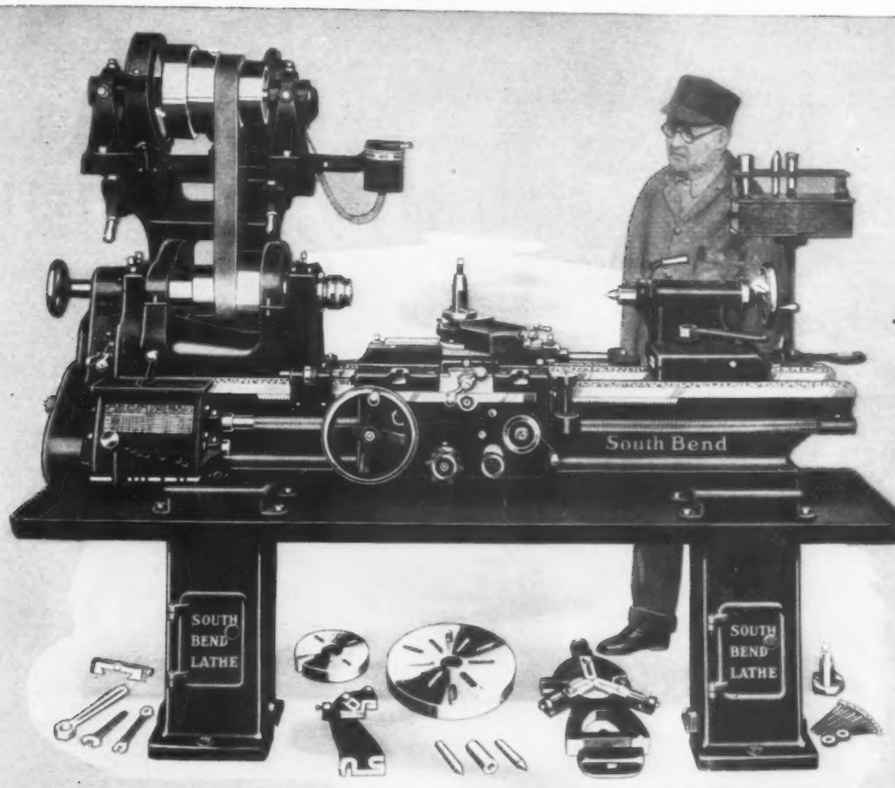
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Your production is dependent upon Monotrol's efficiency . . . may we explain how you will profit from an installation of this lathe which accepts the modern challenge of industry—greater production at less cost!

The Sidney Machine Tool Co.

SIDNEY, OHIO





16″ x 6′
NEW MODEL CABINET LEG LATHE
$859

Reversing Motor, Reversing Switch, Oil Pan, Cabinet Legs and Lathe Equipment included in price.

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For Manufacturing, Production and the Tool Room

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Established 1906
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for 23 years

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in use in the U. S.
and 78 other countries

Plant of the South Bend Lathe Works

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52 widely scattered Dealers visited in 1 month by Telephone



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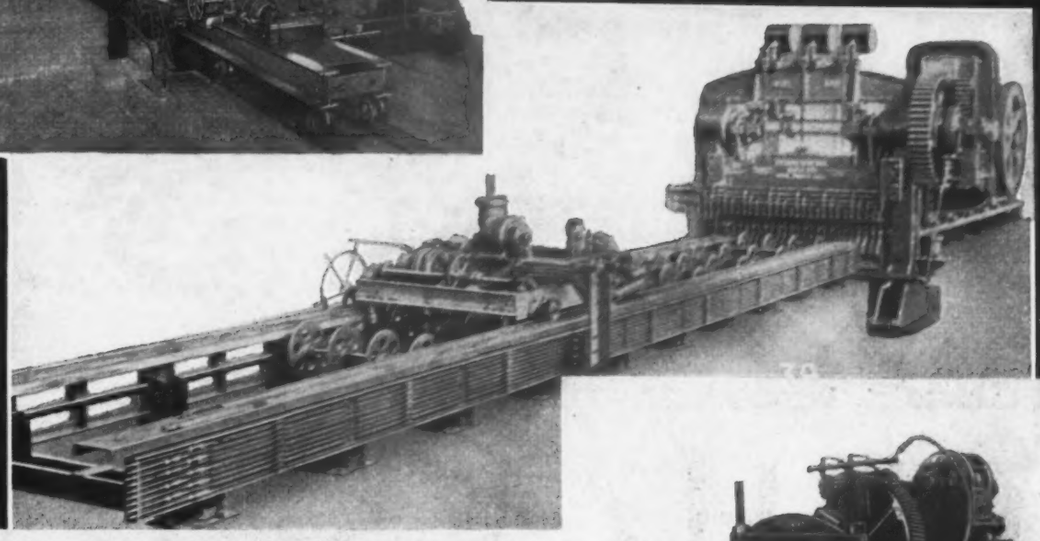
The use of trading area calls by business houses is growing so fast because it pays. It is quick and inexpensive to go by telephone. Men find that telephone calls get attention. They encourage prompt decisions. They enable transactions to be consummated in minutes. They enable each man to go farther and accomplish more.

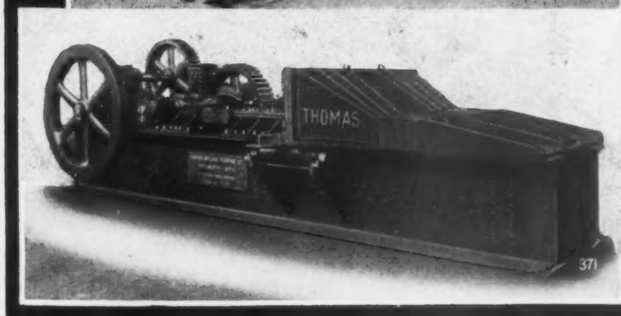
Territory development and the telephone go hand in hand. Telephone calls and personal calls can be alternated. Towns that otherwise would be missed because of lack of time can be reached quickly and economically by telephone from central points. For buying, selling, developing good-will—the telephone will keep you in constant touch with your entire territory. Develop your business area to the full by telephone calls . . . *Quick . . . Easy . . . Economical.*

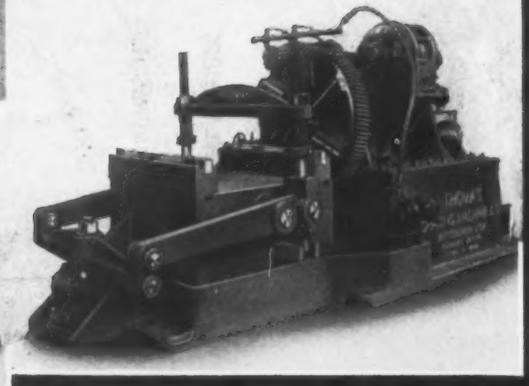
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AMERICAN TELEPHONE & TELEGRAPH CO.
AND ASSOCIATED COMPANIES

COMPETITION CRIES — "FASTER"! "FASTER!"









Upper left shows Multiple Drill with Index Table. Center photo is Multiple Punch and Auto Spacing Table. Lower left shows Bending and Straightening Machine. Lower right is the Column Facing Machine

a bid that was too high ▲ ▲ ▲ a delivery that was too long ▲ ▲ ▲ a job lost ▲ ▲ ▲ a profit gone ▲

thomas presents a few recent developments ▲ ▲ ▲ designed to enable the fabricator to more successfully meet ▲ ▲ ▲ the modern competition ▲

Thomas Spacing Machine Company

Chicago Pittsburgh Phila.



PERHAPS . . . .

HE IS THE ONLY MAN WHO KNOWS

"Here we have a new product—and it must be plated—for appearance, for wear—for rust resistance.

We don't know anyone who has done it—but we do know who will help us.

Hanson-Munning has always pioneered in the plating industry. From the first commercial plating generator down to the present full automatic plating conveyor, they have led the way in the field of plating and the finishing of metals.

Let's call in the Hanson-Munning man—perhaps he is the only one who knows."

HANSON-MUNNING PRODUCTS
Polishing machines, Lathes, Plating Equipment, Generators, Barrels, Tanks, Wheels, Abrasives, Buffs, Brushes, Compositions, Cleaners, Anodes and Salts

HANSON MUNNING

Leading manufacturers of polishing and plating equipment and supplies

Hanson-Van Winkle-Munning Co., Matawan, N. J., and Chicago

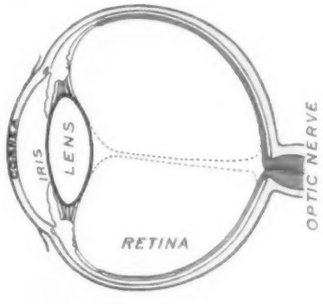
2985

Tall ones see farther than short ones





SEEING is simply the brain cell impression of light which enters the eyes. So we can see to any distance from which light can reach the eyes. And, the earth being round, the higher one's eyes are—other things being equal—the farther will be the distance over the earth's curve from which light can reach them.



Like a camera—the eye. Light enters the lens (pupil)—strikes the film (retina)—and the optic nerve carries the "negatives" into the brain, where they are developed. Quality of light reflected by the object determines sharpness of the picture.

Obvious though it is, this point is made here, merely to illustrate and to emphasize one reason why your eyes see more sharply and clearly by Cooper Hewitt light.

It's because, from the long (50-inch) tube of this radiant mercury-vapor lamp, *more light* can reach your eyes than from a point source of light. There is almost perfect diffusion of light. Wider areas are illuminated. And light reaches your eyes from within, around and from under machinery and other objects in every place where it is used.

Not only that, but the *quality* of Cooper Hewitt light *affords greater seeing power.* Its luminosity is composed *almost wholly* of the *cool, yellow-green* rays of the spectrum—known to science as the *best-seeing* rays. All objects, under Cooper Hewitt light, stand out as sharply and clearly as if magnified. And there's *no glare—no dark shadows*—because the factors which produce these are absent from Cooper Hewitt light.



The Cooper Hewitt spectrum shows that over 90% of its luminosity is in the cool yellow-green rays—the best-seeing rays known to science.

We should like to prove these and other advantages by a trial installation. There is no obligation to purchase. Address: Cooper Hewitt Electric Co., Hoboken, N. J.

COOPER HEWITT

A General Electric Organization

[See next page]

There's the warmth of Humanity



in these cold statistics

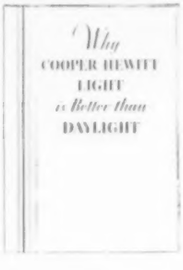
As straws show which way the wind blows, so commonplace figures in a bookkeeper's ledger may often tell a story that truly ennobles humankind. Here, for example, told in such figures, is a story which plainly says:

Every year executives in American industry give more and more thought to the welfare of their employees. Every year sees more and more industries turning to those inventions and devices which modern knowledge has found to be of benefit in promoting the comfort and health of workmen. And in very recent years this trend has advanced most remarkably —including, indeed, a rapidly growing appreciation of what science has lately disclosed as of utmost importance to both the workman and industry—proper and adequate illumination.

Here are the figures which tell that story: The sale of Cooper Hewitt mercury vapor lamps exceeded in 1929 the previous *record* year by *33⅓ per cent.* The best scientific authorities agree that this is the light by which human eyes see best.

Since 1903, when the Cooper Hewitt system of mercury vapor illumination for industrial plants was first introduced, more and more outstanding American industries every year have been turning to its use Today, no industry where Cooper Hewitt lighting is at all feasible goes unrepresented in the list of enthusiastic users. May we demonstrate, by a trial installation in your plant, the many advantages of this remarkable light? Cooper Hewitt Electric Co., 833 Adams Street, Hoboken, N. J.

AN interesting, simply written booklet on the interesting subject of light and the problems of factory lighting is yours for the asking. It explains, as its title indicates, "Why Cooper Hewitt Light is Better Than Daylight." Write for it.





BETTER THAN DAYLIGHT

COOPER HEWITT

A General Electric Organization

415a © C. H. E. Co.: 1929

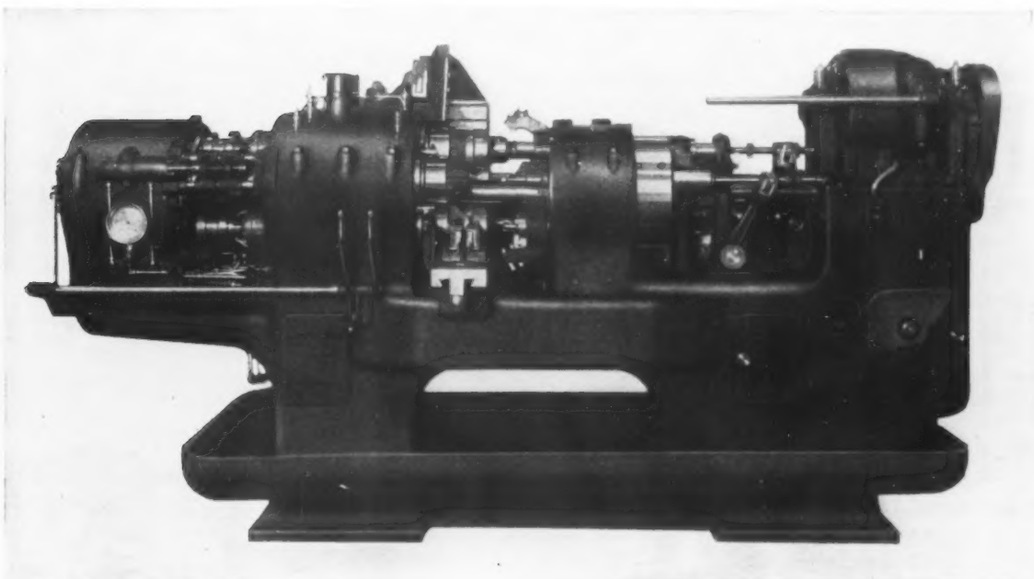
New Size, New Capacity, New HYDRAULIC CONTROL

...In this 7-inch, 5-Spindle, Cleveland Automatic Chucker

WITH 7-inch capacity, 5-spindle performance, this new Cleveland Automatic Chucking Machine offers an oil operated hydraulic chucking action which attracted wide attention at the recent machine tool show.

Aside from the source of power used to drive it, this machine is entirely self dependent. The expense of a compressor and connections is avoided and it is not subject to the fluxations of power, experienced where air lines have excess demands for other purposes.

Its hydraulic chucking unit includes high and low pressure oil pumps, a pressure changing mechanism and built-in control valve, mounted on the oil supply reservoir. Hydraulic chucking offers a positive chucking force, equal to any demand, yet conformable to the variations in the castings and forgings and with pressure adjustable to the nature of the work.



Highly accessible in all its parts, the machine is tooled and operated by an operator standing at all times in front of the machine. Its 7-inch capacity and its five spindle operation offers a new standard for multiplicity of cuts on large work.

Send for a bulletin describing this machine in detail and rely on Cleveland Automatic engineers to suggest the special tooling application that fits your problem.

CLEVELAND AUTOMATICS

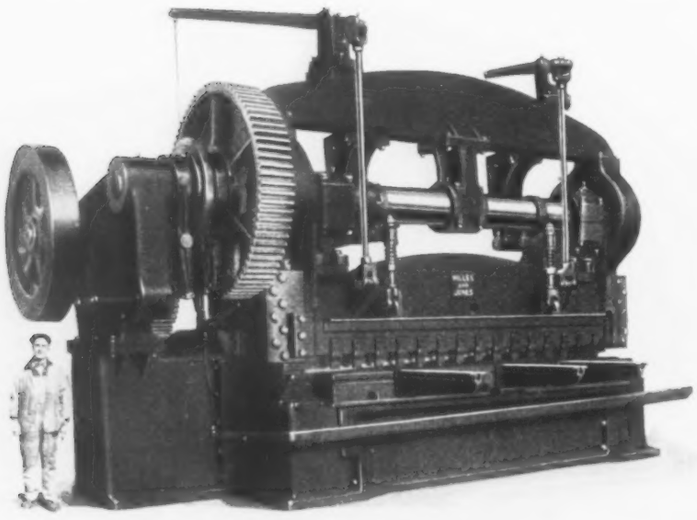
THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 E. 65th St., Cleveland, Ohio, U. S. A.

NEW YORK
95 Liberty Street

CHICAGO
565 W. Washington Boulevard

DETROIT
1217 Book Building

MACHINE TOOLS



HILLES & JONES Gate Shears

HILLES & JONES Gate Shears are made in sizes to fit your production needs. The machine illustrated has a capacity for shearing silicon steel plate 1¼" thick and 144" wide. The blades are 179" long and are rectangular with four cutting edges.

Parts submitted to strain are heavy section cast steel. Sliding bearings are equipped with removable bronze wearing plates and bronze taper gibs for maintaining alignment of sliding parts. Easy control. All gears guarded.

BETTS

Engine Lathes
Boring Mills—All Sizes
Planers—All Sizes
Heavy Duty Slotters
Railroad Shop Tools
Car Wheel Borers, etc.

COLBURN

Drill Presses
Heavy Duty Drills
Gang Drills
Boring and Turning Mills
Special Drills, etc.
Multiple Spindle Drills
(Vertical and Horizontal Types)
Multiple Spindle Rail Drills
Staybolt Threading Machines
Taper Bolt Turning Machines

NEWTON

Horizontal Milling Machines
Planetary Milling Machines
Vertical Milling Machines
Continuous Milling Machines
High Production Tools
Locomotive Shop Tools
Rod Boring Machines
Crank Planers, Rail Drills
Column Facing Machines
Slotters, Rotary Planers, etc.

HILLES & JONES

Punches and Shears
Bending Rolls
Straightening Rolls
Flanging Clamps
Plate Planers, etc.

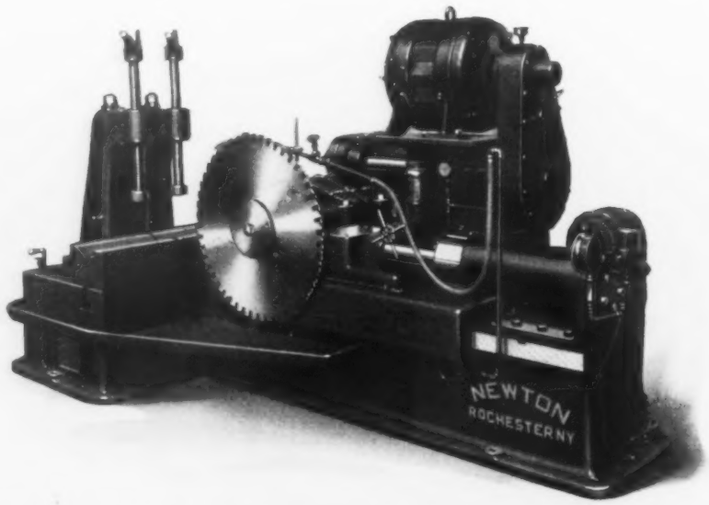
MODERN

Magic Quick-Change Drill Chucks
Self-Opening Die Heads
Chaser Grinding Machines
Inserted-Tooth Milling Cutters
Threading Machines
Self-Opening Stud Setters
Collapsible Taps, etc.

NEWTON
Hydraulic Feed Cold Saw

That the Newton Hydraulic Feed Cold Saw sets a new standard for operating speed is evidenced by its time of 3½ minutes for sawing a 9½" Bar of S. A. E. 1040 Steel. This is a production rate that can be maintained in your shop day after day. Hydraulic pressure actuates Feed and Rapid Traverse giving a feed range of 1" to 19" per minute and a power rapid traverse in either direction of 78" per minute. The saw blade cuts up, throwing thrust down on the large bearing surface on the base and gives 300% or more increase in feed rate over the old style mechanical feed saw.

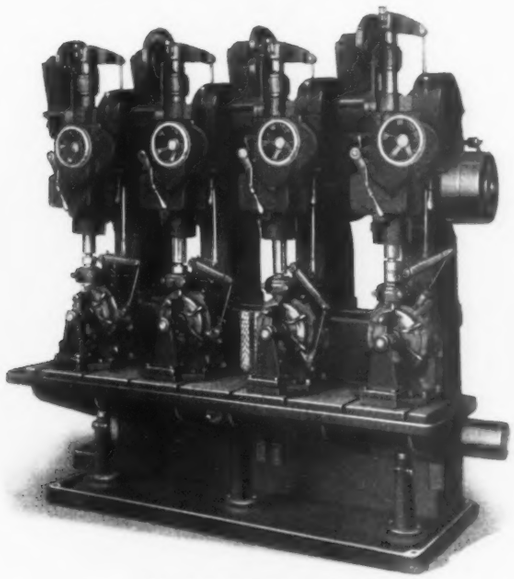
Newton Hydraulic Feed Cold Saws come in blade sizes from 36" to 90".



BETTS : COLBURN : NEWTON : HILLES & JONES : MODERN

CONSOLIDATED

That Are Setting Production Records



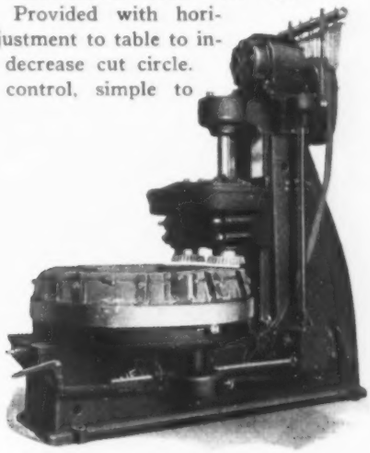
COLBURN No. 2
Four Spindle Drill Press

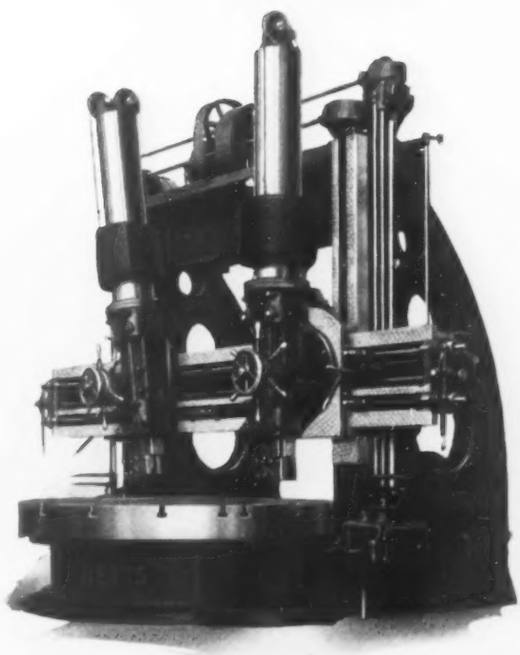
A rapid production machine with spindles timed for continuous production. Cam feed equipped with four automatic indexing holding fixtures. This machine hollow mills 8400 top rib sockets in 16 hours.

Colburn Manufacturing Type Drill Presses are built in a wide range of sizes and furnished in single spindle, 2, 3 and 4 spindle gang types for various production operations.

NEWTON
Continuous Vertical Milling Machine

Adapted for light, medium or heavy milling. Built with a wide range of table diameters in both single and double spindle types. Can be arranged for continuous or intermittent feed with rapid traverse. Provided with horizontal adjustment to table to increase or decrease cut circle. Easy to control, simple to operate.





BETTS
Heavy Duty Boring Mill

The ability of Betts Heavy Duty Boring Mills to stand up under most severe operating conditions, combined with convenience of operation, make them the choice in shops of every line of manufacture.

Smooth running of these machines is insured by the use of internal gear ring of wide face and coarse pitch, dowelled and bolted on, for driving the table. Exclusive Betts design ring type counterweights provide proper balance for tool spindles at any position, at steep angles or vertical. Betts patented arrangement of levers, fastened on the operating side of saddles permits engagement, disengagement and reversal of direction of feed or power rapid traverse direct from the saddle.

Betts Heavy Duty Boring Mills are built in sizes from 60" up to the largest required. Illustration shows mill with a swing of 100".

Consolidated Machine Tool Corporation
of America
ROCHESTER, NEW YORK

BETTS : COLBURN : NEWTON : HILLES & JONES : MODERN

CONSOLIDATED

What are your plans for 1930?

When you and your associates discuss business plans for 1930 and the question of a more helpful banking connection comes up, we invite you personally to investigate the facilities of The Equitable.

* * *

You probably know that The Equitable today stands well-equipped with those attributes which big banks frequently bring to the attention of the public—but how do these facilities become more valuable in one institution than in another?

We have made Equitable banking a human service. Its true worth to the business man cannot be measured by the mere routine of the teller and loan clerk. It lies beyond the bank wickets in the friendship, knowledge and experience of the bank's officers.

When a man places his business or personal account with us, he not only links his name and credit with one of the country's largest banks, but acquires the services of a group of business and financial counsellors whose sympathetic cooperation is limited only by the extent to which he takes our official family into his confidence.

* * *

What does this mean to you as a prospective Equitable depositor?

Just this . . . When you walk into a bank you usually bring with you a financial problem. You may send a clerk or secretary to deposit money, to draw a payroll or even to buy securities or arrange a foreign draft, but when a real financial problem arises you come in personally.

It then becomes apparent that the real value of your bank is determined by the prompt, sympathetic and undivided attention of a competent executive who, from his knowledge of the banking profession and his past experience with similar financial problems, will be able to give you a satisfactory solution to your problem.

Take for granted the wide attributes of modern banking, but remember that Equitable Service reaches beyond. It centers in the friendship, experience, and knowledge of our officers and their ability and willingness to use the facilities of a great modern bank in serving you.

The Equitable Trust Company

OF NEW YORK

Head Office: 11 Broad Street

A merger of The Seaboard National Bank and The Equitable Trust Company of New York

LONDON · PARIS · MEXICO CITY

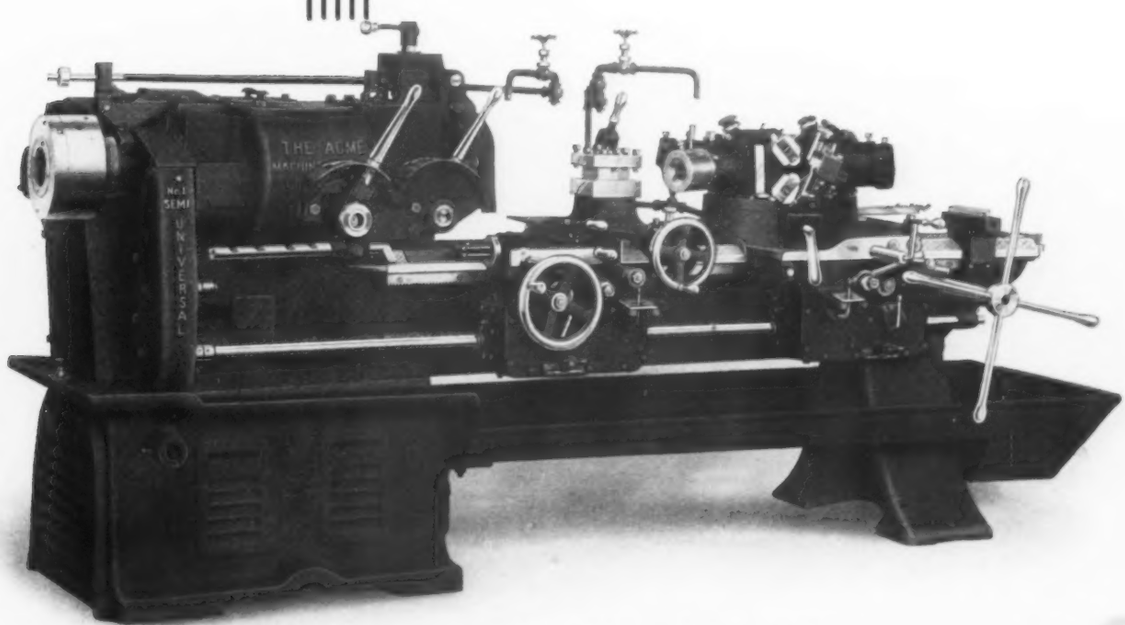
Total resources more than $800,000,000

ACME Again to the Forefront

A distinctly new ACME Turret Lathe with many exclusive features

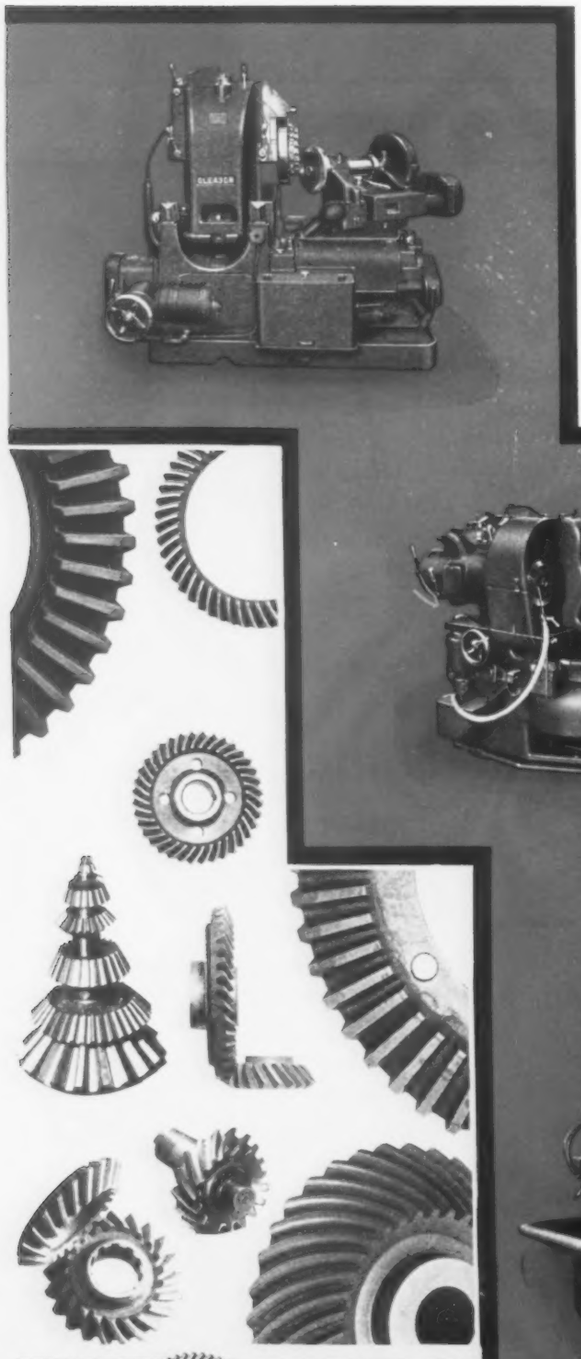
12 reversible spindle speeds.
Multiple splined alloy steel sliding gears.
Timken mounted transmission shafts.
Roller bearing superior mounted spindle.
All gears in head heat-treated and hardened.
Simple 2-lever control.
12 independent reversible feeds in each apron.
Heat treated sliding gears in both aprons and headstock.
Ball bearing mounted change gear shafts in aprons.
No loose sliding keys.
Roller bearing superior mounted spindle.

The Acme Machine Tool Co.
Cincinnati, Ohio U. S. A.



New—No. 1 Universal Turret Lathe

-- BEVEL GEAR AUXILIARY



One of the most vital parts of any machine is the gears. Poor or worn gears usually result in a tie-up which means considerable replacement expense and costly delays in production. The Gleason Works has specialized in the manufacture of Bevel Gears and Bevel Gear Cutting Machinery for over 60 years and offers the services of their engineers and the benefit of their experience in assisting you with your gear problems.

The Gleason line includes all types of ma-

GLEASON WORKS

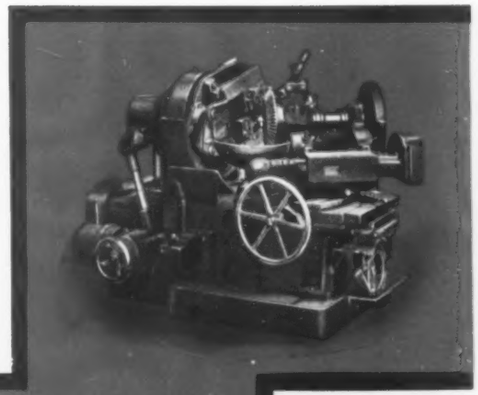
Builders of Gear Cutting Machinery and Auxiliary Equipment for Over Sixty Years

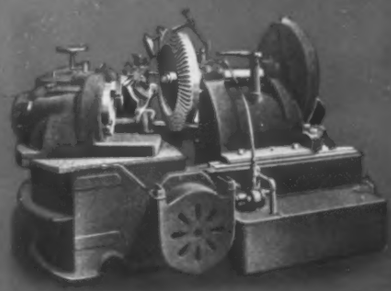
1000 UNIVERSITY AVENUE, ROCHESTER, N.Y., U.S.A.

MACHINERY and EQUIPMENT

chines for the production of Straight and Spiral Bevel and Hypoid Gears. Machines are built for finish cutting in large quantities, others for both rough and finish cutting in small quantities. Testers, Lappers and Quenching Presses for use after the gears are cut, are also products of the Gleason Works.

Production estimates on your gears will be given gladly on receipt of blue prints and the proper machine for your requirements will be recommended. Send for complete information on the Gleason Equipment for cutting your gears.































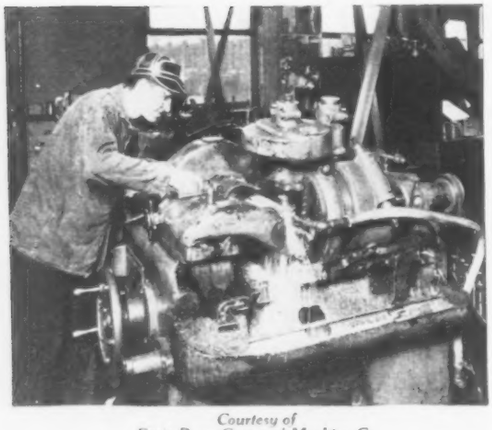
GLEASON WORKS

Builders of Gear Cutting Machinery and Auxiliary Equipment for Over Sixty Years

1000 UNIVERSITY AVENUE ROCHESTER, N.Y. U.S.A.

Better Finish . . .

RESULT FROM *Says* FOOTE BROS. GEAR

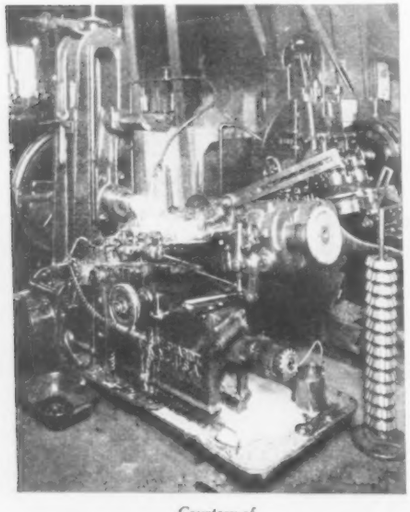


Courtesy of Foote Bros. Gear and Machine Co.

OPERATION: CUTTING TRACTOR GEARS. 4/5-IN. PITCH.
MACHINE: LEES BRADNER HOBBER NO. 507.
MATERIAL: S.A.E. 3145 HEAT TREATED.
SPEED: 85 R.P.M.
FEED: .050 IN. TO ONE REVOLUTION OF HOB.
DEPTH OF CUT: .450 IN.
LUBRICANT: 1 PART SUNOCO TO 12 PARTS WATER.

FOOTE BROS. Gear and Machine Company of Chicago are well-known manufacturers of Gears, Speed Reducers, Flexible Couplings, Power Transmissions and Road Machinery.

To maintain a fast production rate, heavy roughing cuts must be made with resultant hard usage of tools. They find that SUNOCO, by reducing the frequency of tool grindings, speeds up production. They also know that a fine finish results from the use of SUNOCO, even at fast speeds and maximum feeds.



Courtesy of Foote Bros. Gear and Machine Co.

OPERATION: ROUGHING BEVEL PINIONS. 3-IN. PITCH.
MACHINE: GOULD AND EBERHARDT GEAR ROUGHER.
MATERIAL: S.A.E. 2512.
SPEED: 90 R.P.M.
FEED: 3 IN. PER MINUTE.
DEPTH OF CUT: .719 IN.
LUBRICANT: 1 PART SUNOCO TO 12 PARTS WATER.

SUN OIL COMPANY, Philadelphia

SUN EMULSIFYING

Made by SUN OIL CO. *producers*

AKRON, ALLENTOWN, ATLANTIC CITY, BALTIMORE, BATTLE CREEK, BEAUMONT, BRIDGEPORT, BUFFALO, CHICAGO, CINCINNATI, CLEVELAND, COLUMBUS, DALLAS, DAYTON, DETROIT, FLINT, GRAND RAPIDS

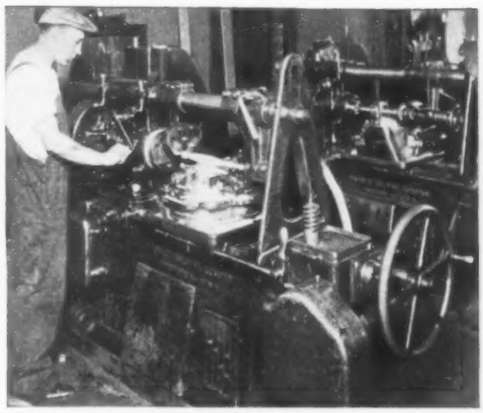
Greater Production

USING SUNOCO AND MACHINE COMPANY

In your own shop, SUNOCO Emulsifying Cutting Oil will:—

1. *Mix easily and stay mixed.*
2. *Be an ideal refrigerant as well as lubricant.*
3. *Act as a perfect rust preventive.*
4. *Prevent system from clogging.*
5. *Make oil renewals necessary much less often.*
6. *Permit higher speeds and heavier cuts with better finish.*
7. *Never turn rancid, for it contains no animal or vegetable fats.*
8. *Prove to contain no rosin or rosin oil.*
9. *Keep workmen's hands in better condition.*

SUN CIL COMPANY ENGINEERS have offered many valuable suggestions at no cost to manufacturers for lowering production costs and increasing outputs. Prompt and intelligent attention is given to all inquiries addressed direct to Headquarters or to any of our branches.



Courtesy of Foote Bros. Gear and Machine Co.

OPERATION: CUTTING 6-IN. SPLINE SHAFTS.
MACHINE: BARBER-COLMAN HOBBING MACHINE.
MATERIAL: S.A.E. 3140.
SPEED: 90 R.P.M.
FEED: .025 IN. TO ONE REVOLUTION OF HOB.
DEPTH: .125 IN.
LUBRICANT: 1 PART SUNOCO TO 12 PARTS WATER.

SUN OIL COMPANY, Ltd., Montreal

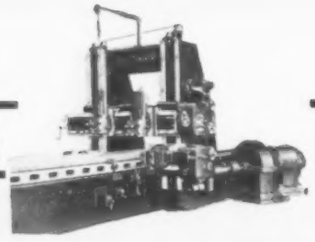
OCO
CUTTING OIL
of BLUE SUNOCO MOTOR FUEL

OPERATION: GRINDING SOFT STEEL GEAR BLANKS, 18 AT A TIME.
MACHINE: BLANCHARD SURFACE GRINDER, 26-IN., ONE-PIECE MAGNETIC CHUCK.
WHEEL: NORTON SILICATE, 16 IN. X 5 IN. X 1½ IN.
WHEEL SPEED: 1000 R.P.M.
LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER.



Courtesy of Foote Bros. Gear and Machine Co.

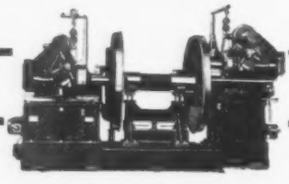
JACKSON, MICH. JACKSONVILLE MIAMI MONTREAL NEWARK NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE READING ROCHESTER SYRACUSE TAMPA TOLEDO TORONTO TRENTON TULSA WILMINGTON

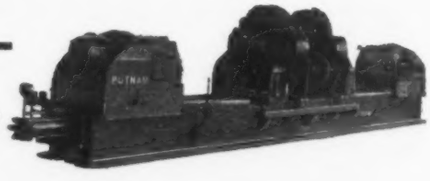
PUTNAM  MACHINE TOOLS

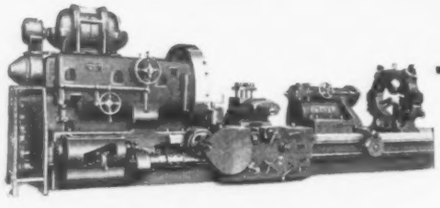
FOR AUTOMOBILE  PLANTS,

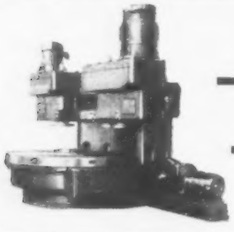
RAILROAD  SHOPS . . . .

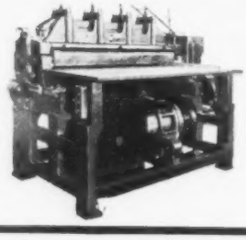
AND  FOR GENERAL

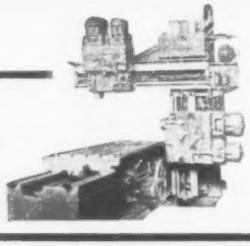
INDUSTRIAL  PURPOSES

ARE MADE AT THE 

PUTNAM  MACHINE

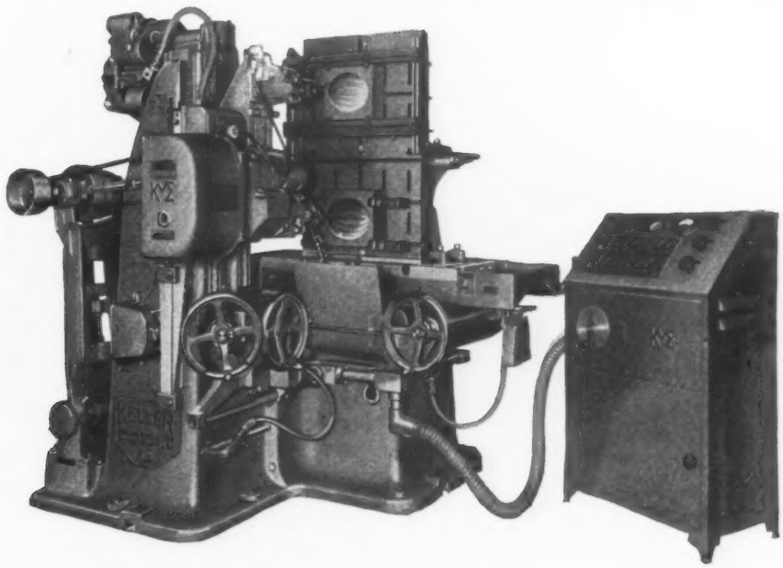
 WORKS, FITCHBURG

MASSACHUSETTS  OWNED

AND  OPERATED BY

MANNING, MAXWELL & MOORE, Inc.

THE KELLER



Automatic Tool Room Machine

Type BL-2416

is one of a complete line of Machines used for every type and size of die and mold work. The KELLER METHOD does more for the tool room than even the figures illustrating its striking economies can show. It removes the uncertainty of cost and result that is inseparable from older methods. Through mechanical skill it replaces the constant decrease in the supply of tool makers. It makes practicable the production of dies impossible to cut by any other method.

The KELLERFLEX



The latest addition to the Kellerflex line is the JR-5, a ONE HORSE POWER Machine for heavy grinding. Heavy handpiece with wheel guard and outboard handle accommodates grinding wheels up to 8 inches diameter. The machine is balanced and shaft supported to give maximum safety and eliminate operating fatigue.

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All Kellerflex Machines mounted on universal swivel for complete flexibility; ball bearing motors run equally well in all positions; multi-speed machines have simple speed changing and belt tightening device; drive completely ball or roller bearing; sheath length adjustable to prevent shaft buckling.



Equipment and accessories can be furnished for every type of operation.

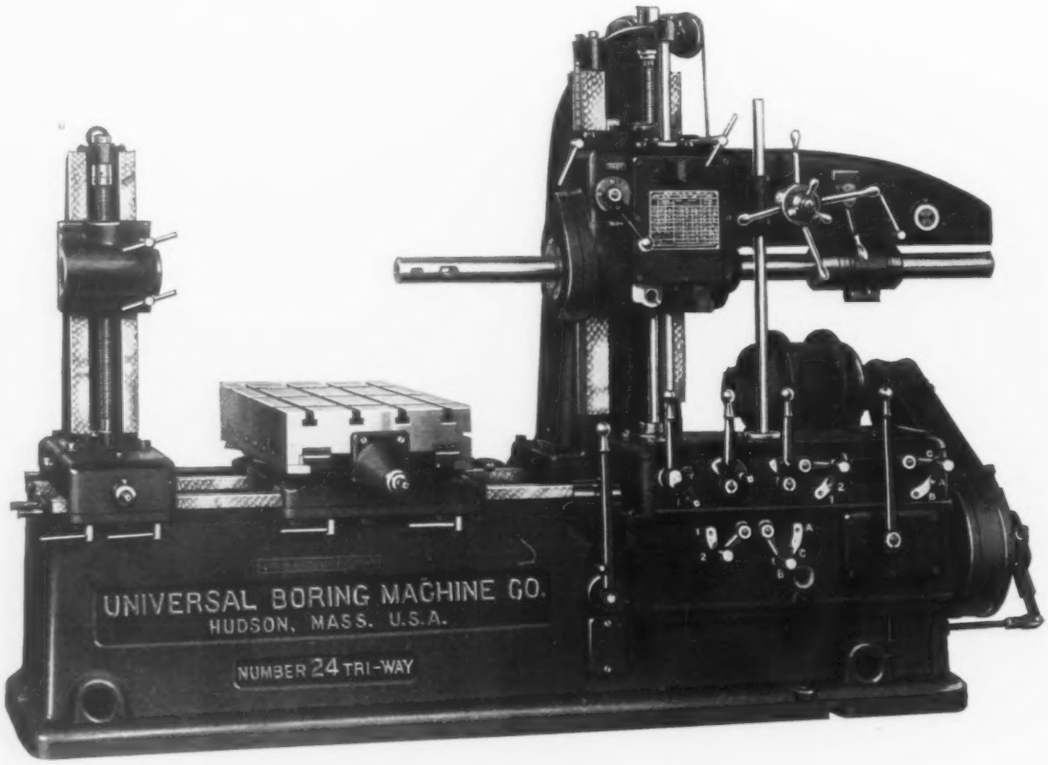
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Horizontal Boring Machine

A small Horizontal Boring Machine for very accurate work on Jigs, Tools and Fixtures. Very high speed range, with one spindle.



"Where Accuracy Counts, We Win"

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Manufacturers of Universal (Horizontal) Boring Machines, Tri-Way Type
HUDSON, MASS., U. S. A.

Number 24 Tri-way

A small Horizontal Boring Machine for small accurate work on Jigs, Fixtures and Tools. It is very heavy and powerful, capable of heavy boring and milling.

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of heat treated alloy steel, is mounted on Timken Roller Bearings. The use of tapered Roller Bearings for mounting the Spindle sleeve permits the use of high spindle speeds, with one spindle, with safety, reduces vibration and chatter and eliminates the slight difference between the running and standing positions of the spindle present with plain bearings. This last feature is of the highest importance in jig and fixture work, particularly of the type now so commonly found in many tool shops. This construction makes it possible to build into the machine a very high degree of accuracy, and to maintain that accuracy over many years of service. Suitable provision is made for adjustment to compensate for wear.

An Improved Vernier Attachment

can be supplied for work requiring the highest degree of precision.

By the use of this attachment, jigs and experimental work can be bored to close measurements, and the accuracy of the machine is made independent of the wear in the feed screws; at the same time, the attachment does not interfere with the use of the rapid traverse for quick locating, and permits the application of the horizontal boring machine to jobs for which, formerly, machines especially built for jig boring have been considered necessary.

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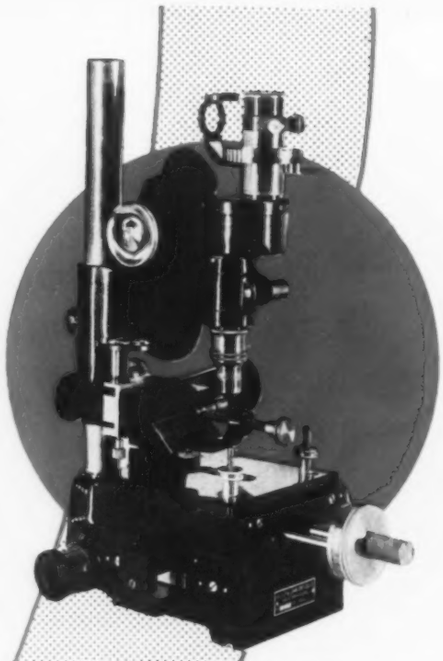
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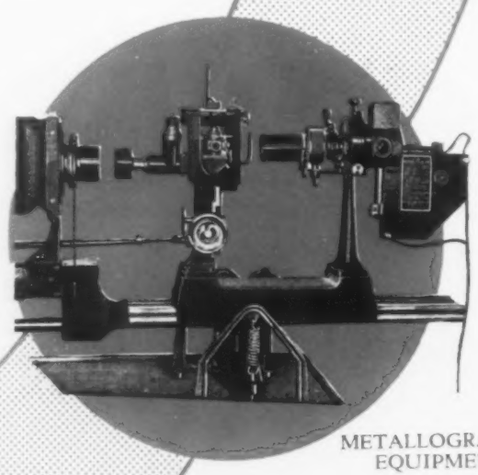
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1930

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PRODUCTION INCREASED 1600%

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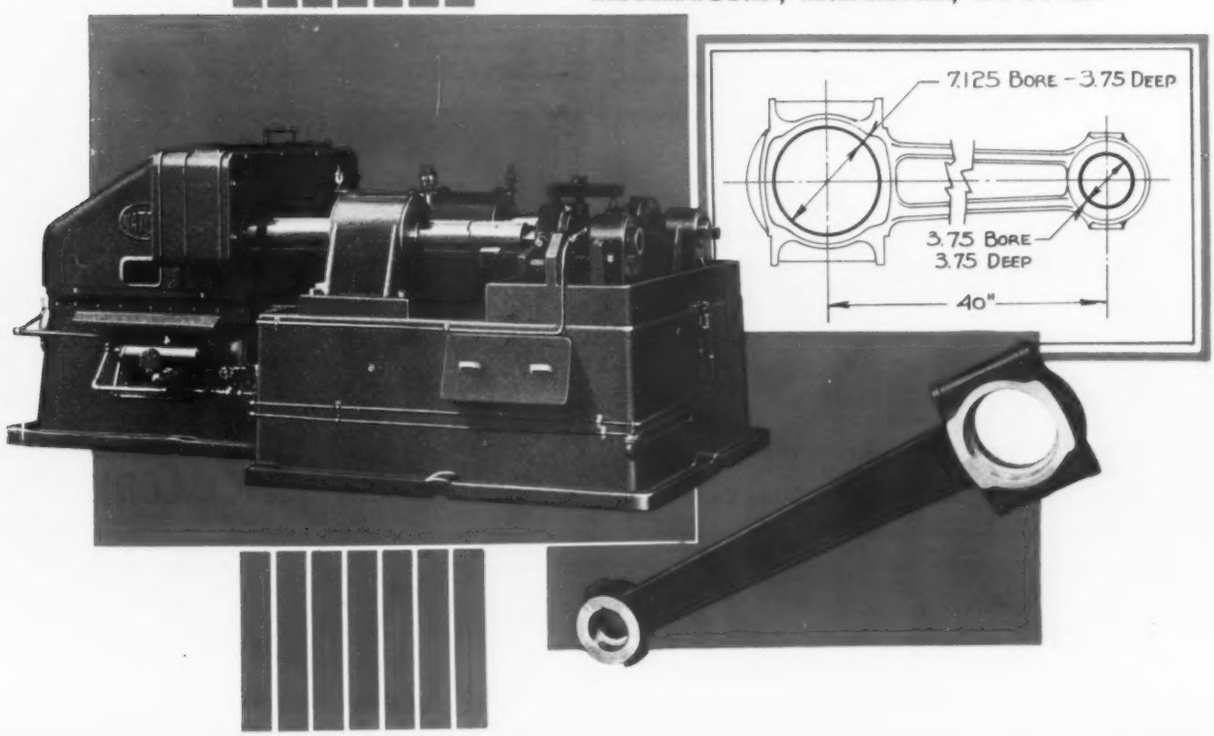
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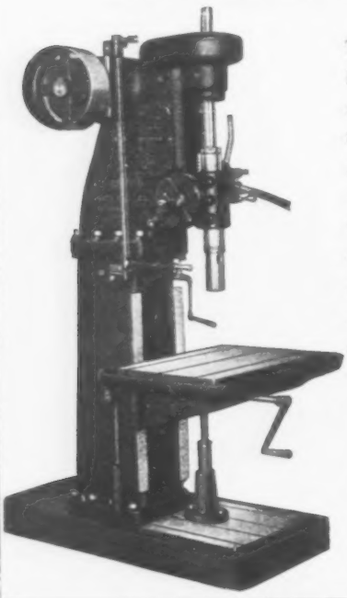
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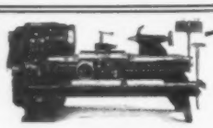


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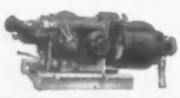
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One to Six Spindles
Tapping Attachments and Multiple Heads

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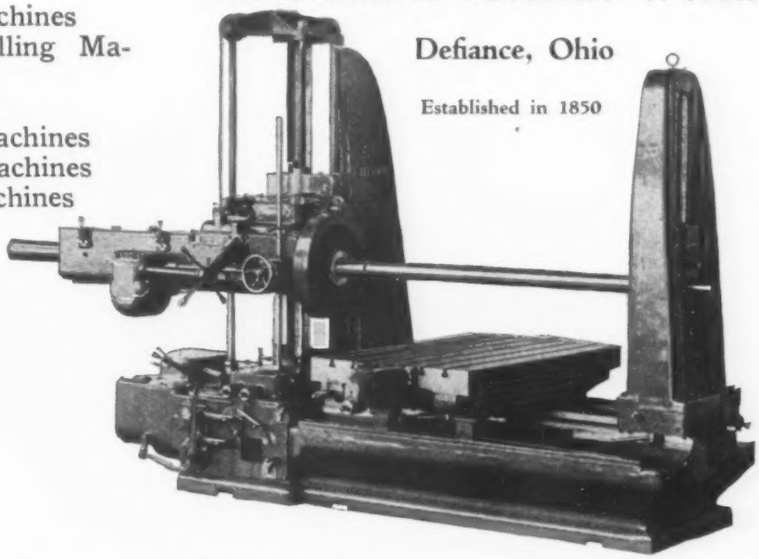
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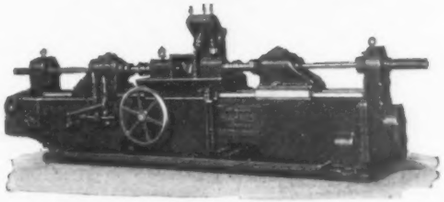
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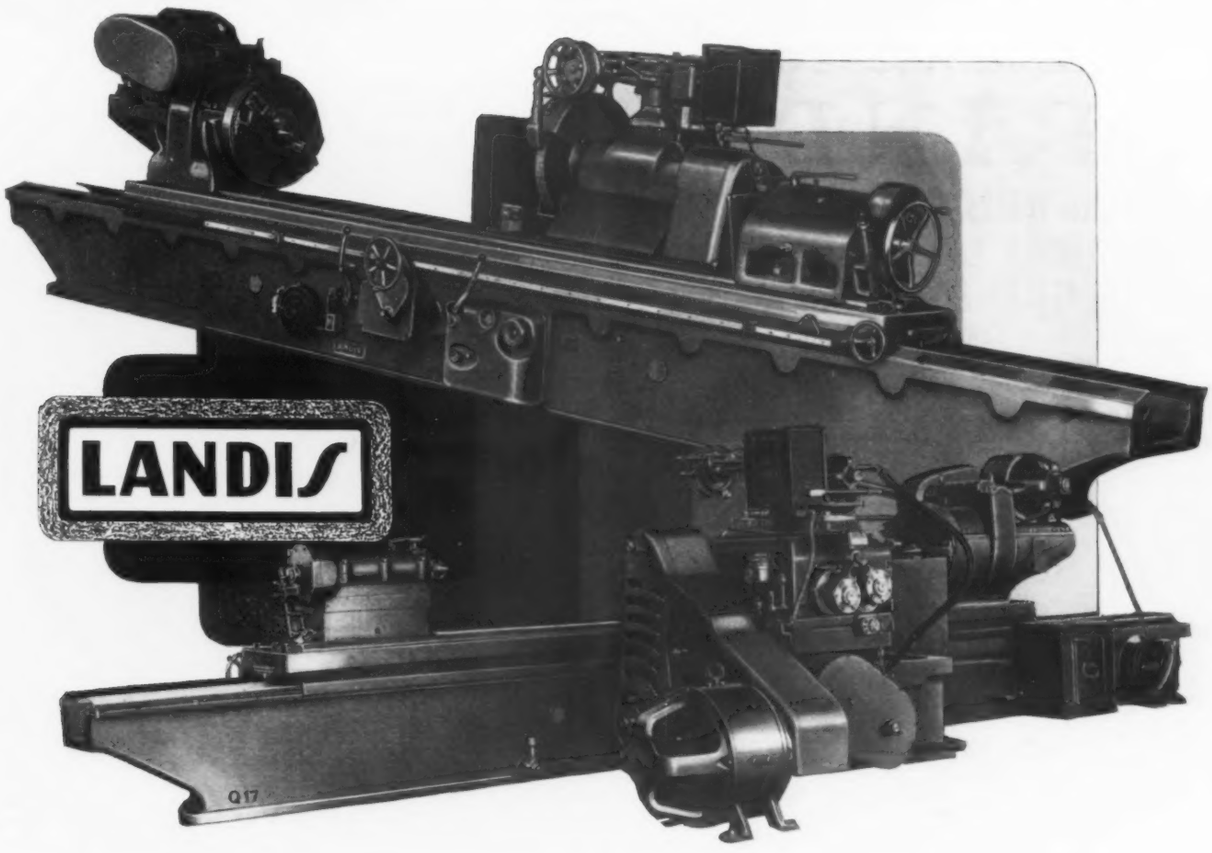
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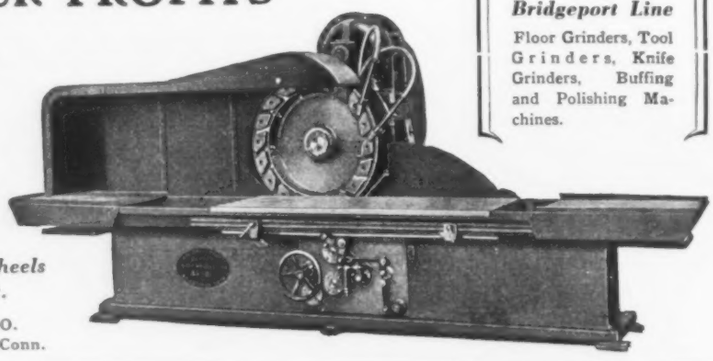
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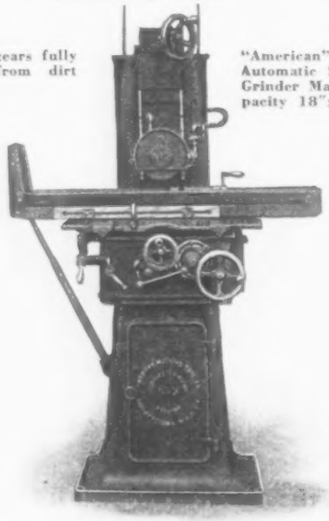
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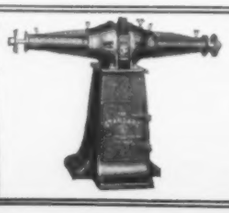
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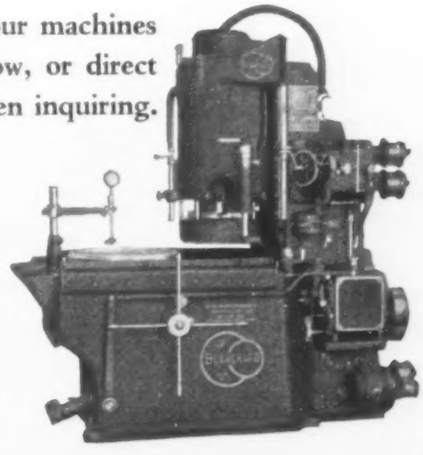
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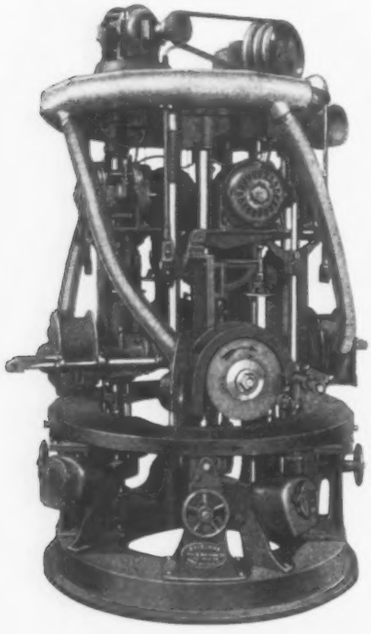
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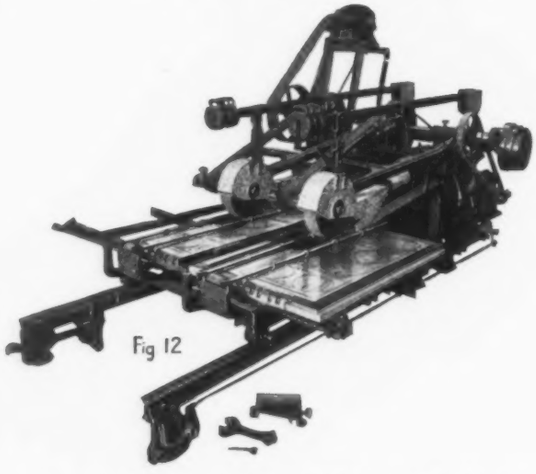
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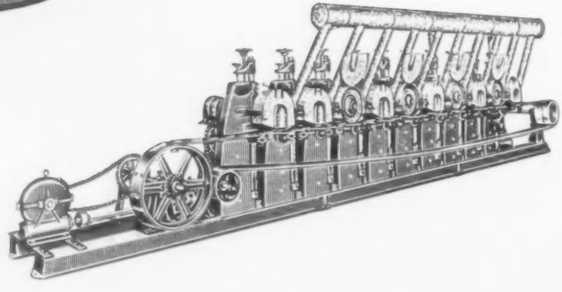
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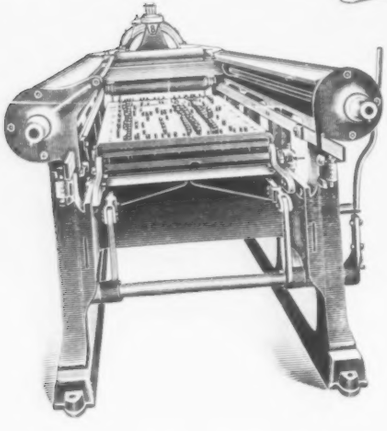
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4 Wheel Circular
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Continuous Feed
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Single or Double Wheels
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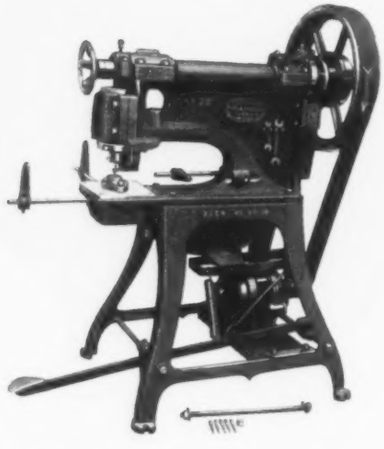


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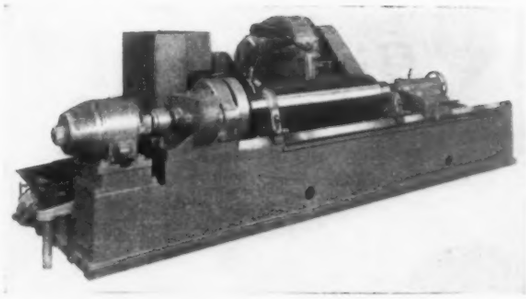
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This new machine tool was designed for better, faster and cheaper grinding to the extreme limits of accuracy and finish required by modern industry.

Large grinding wheel driven by individual motor through multiple V belt—improved type spindle mounting—centralized electrical control—crowning device, accurate and easily set—carriage traverse drive of unusual smoothness—lifetime inverted V ways—precision construction—heavy, substantial and rugged design—are some of the outstanding reasons for the exceptional results obtained.





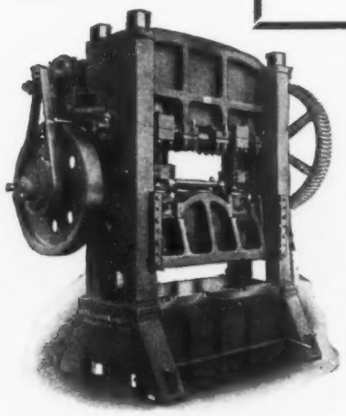
M & P "Easy Clean" Blast Gates

This new design blast gate offers a quick and easy method of cleaning or repairing without removing the body from the pipe line. Both the body flanges, the cap and head are drilled to the same jig, permitting assembly of the head on either side, whichever is more convenient for operating the gate. The unusually long machined bearing for the slide provides a closer, tighter fitting joint.

Send for information about M & P Blast Gates for controlling air, gas, granular materials, etc.

MINER & PECK DEPT.

L & N Straight Sided Double Crank Presses



These L & N presses are made in different types and sizes for a wide range of application. Improvements in design give the rigidity and strength essential for the heavy gauges and higher speeds, providing a smooth running, dependable machine that will give uninterrupted service in continuous production.

Investigate the L & N line of presses and other sheet metal working machinery.

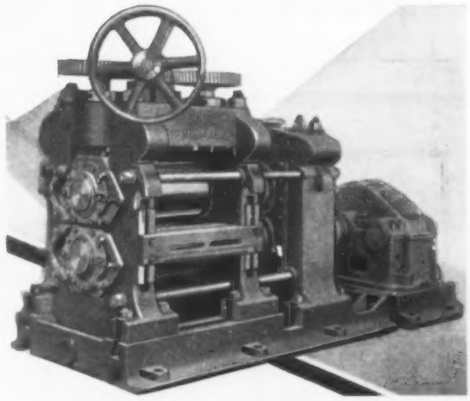
LOY & NAWRATH DIVISION

FARREL Indicating Caliper

The accuracy of your rolls depends upon the precision with which they are ground.

This indicating caliper is invaluable for gauging rolls for accuracy of diameter and for amount of crown or concavity. It will indicate the slightest variation in the diameter of a roll at any point in its length. It is easily manipulated and gives positive readings free from chatter of the indicator needle.

Farrel Indicating Calipers will eliminate guess work in the measuring of rolls.



FARREL Rolling Mill

You can place your confidence in Farrel-Birmingham Rolling Mills for highest measure of performance and operating economies.

Anti-friction bearings throughout—on the rolls, pinions and reduction gears; Farrel-Sykes double helical mill pinions and reduction gears; universal joints connecting rolls and pinions; greater precision and accuracy in construction, are some of the features that contribute to low power consumption, maintenance expense and labor costs, and increased production and profit.

Consult our engineers.

FARREL-BIRMINGHAM COMPANY Inc.

ANSONIA, CONN.

Successor to

FARREL FOUNDRY & MACHINE CO. (EST. 1848)
BIRMINGHAM IRON FOUNDRY (EST. 1836)

Plants at
Ansonia, Conn.
Derby, Conn.
Buffalo, N. Y.

Representatives
in
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Cities

MUMMERT-DIXON *High Speed* GRINDERS

Both types adaptable to 9000 S. F. P. M. rubber or bakelite wheels.



Nos. 518-S and 520-S Suspended Type 18" and 20" Wheel Capacity

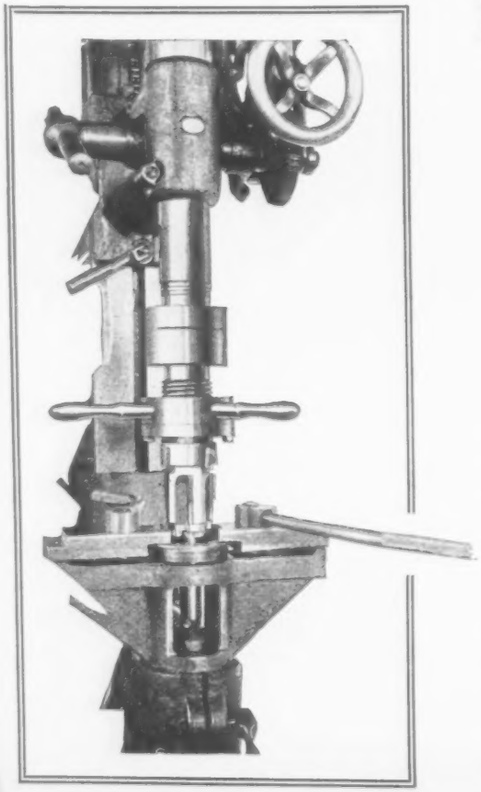
THIS tilting wheel type cuts equally well in any position—even upside down. A seven and a half horse power motor, and ball and roller bearings mean plenty of power.



Nos. 516 and 518 Self-Contained Type Grinding Wheel Capacity 16" x 2½" wheel and 18" x 3" wheel.

THIS semi-portable, self-contained type can be used on a wide range of work. Powerful, but easy to handle—a fine combination of speed plus economy. Insist on a MUMMERT-DIXON. Send for full particulars.

MUMMERT-DIXON CO.
HANOVER, PENNA.



Manufacturers who want BIG PRODUCTION certainly want this tap



It opens and closes automatically, cuts fast and accurately, and speeds up production. Built in capacities from 2" to 16", it is adapted to drill presses, screw machines and boring mills.

Let us give you full information and prices.

PIPE CUTTING and THREADING MACHINES

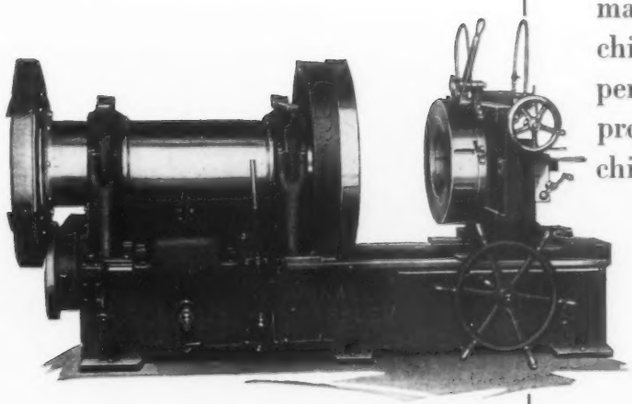
We are specialists in equipment of this type. Let us show you how to get real production on your pipe work.

THE PIPE MACHINERY CO.
930 East 70th Street, CLEVELAND, OHIO

A Cheap Thread is "Cheap" No Matter What It Costs

IF thread cutting is part of your means of making a living, you know the importance of the phrase "clean cut threads, true to form." You'll know, too, that if a defective thread gets into a water, steam, gas, oil or ammonia line, your reputation as a reliable manufacturer is jeopardized.

So why take chances when it's so economical and safe to operate B & K Threading Machines? These machines cost no more than machines of lesser accuracy and dependability, yet they return bigger profits in better work, faster machining and longer life.



BIGNALL & KEELER PIPE MACHINES are built in 17 styles and sizes, one of which will meet your demands. We can equip any of these machines with genuine Landis die-heads or Peerless die-heads as you desire. We also make a Rolling Cutter for all sizes of pipe up to 4".

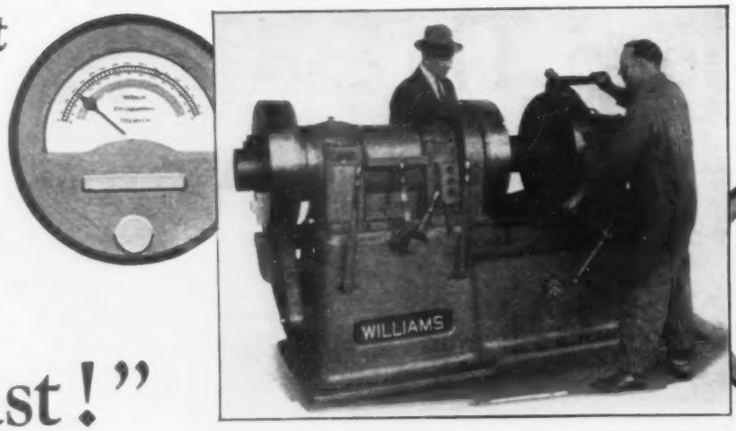
PEERLESS B&K DUPLEX P·D·Q·C

Bignall & Keeler Machine Works of the N. O. Nelson Mfg. Co.

EDWARDSVILLE, ILLINOIS

PEERLESS B&K DUPLEX P·D·Q·C

"The *fastest* pipe threading costs you the least!"



Built from motor to die-head for speed and long life. The last word in machine design, it cuts *more threads* at *less cost.*

The wattmeter shows you why users of WILLIAMS "Rapiductions" are reporting *savings of 25% in their power bills for threading.*

What makes such a power saving possible?

First of all, the WILLIAMS *dies*, which contact the material so that friction is reduced to a new low minimum. The result is higher threading speed with less power—and longer die life.

Complete lubrication makes another power saving. Modern force-feed lubrication to the die-head, machine-cut gears running in oil.

Far lower die cost—
This machine threads all sizes within its range with only one die-head—and only one set of dies for all sizes of pipe using the same pitch of thread.

WILLIAMS dies are substantial but small—held in large die holders. They cost far less than ordinary dies, showing a big saving in a year's work.

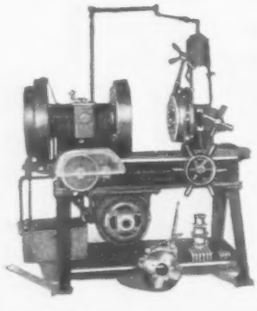
Let us send you some interesting production records and cost figures, of the size "Rapiduction" threading machine that meets your requirements.

WILLIAMS RAPIDUCTION
PIPE, NIPPLE, AND BOLT THREADING MACHINES

WILLIAMS TOOL CORPORATION
1205 Liberty St., Erie, Pa.
Canadian Plant: Brantford, Ontario

SAUNDERS' PORTABLE No. 1 IMPROVED PIPE THREADING & CUTTING MACHINE MOTOR DRIVEN,

Capacity ¼" to 2" Inclusive



A new machine recommended for plumbing and steam-heating work or for industrial plants, either as a PORTABLE or PERMANENT installation.

Equipment: Adjustable Expanding Diehead, Rotary Oil Pump, Reaming and Cutting Off Attachment.

Other types of machines to meet all requirements from ¼" to 18" inclusive. Catalog on request.

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YONKERS, NEW YORK

Peerless High Speed Metal Sawing Machines

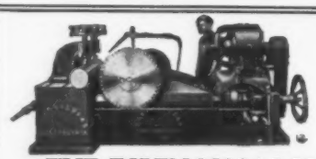
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Blades
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USE PEERLESS
Also Peerless U. S. A. Power Blades and the Peerless Duplex Hand Blades.
Send for details.



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New York Office, 15 Warren St.

The latest development in
THE KELLERFLEX
line of flexible shaft equipment is shown in our full page advertisement on page 119 of this issue. **Keller Mechanical Engineering Corp.**
78 Washington Street, Brooklyn, N.Y.



Cutting Off Machines for Sawing All Kinds of Metals

THE ESPEN-LUCAS MACHINE WORKS
FRONT AND GIRARD AVE. PHILADELPHIA, PENNA.

Curtis

Pipe Cutting and Threading Machines *give* Economy
Hand-Belt-Electric
Ranges ¼-2" to 8-16"

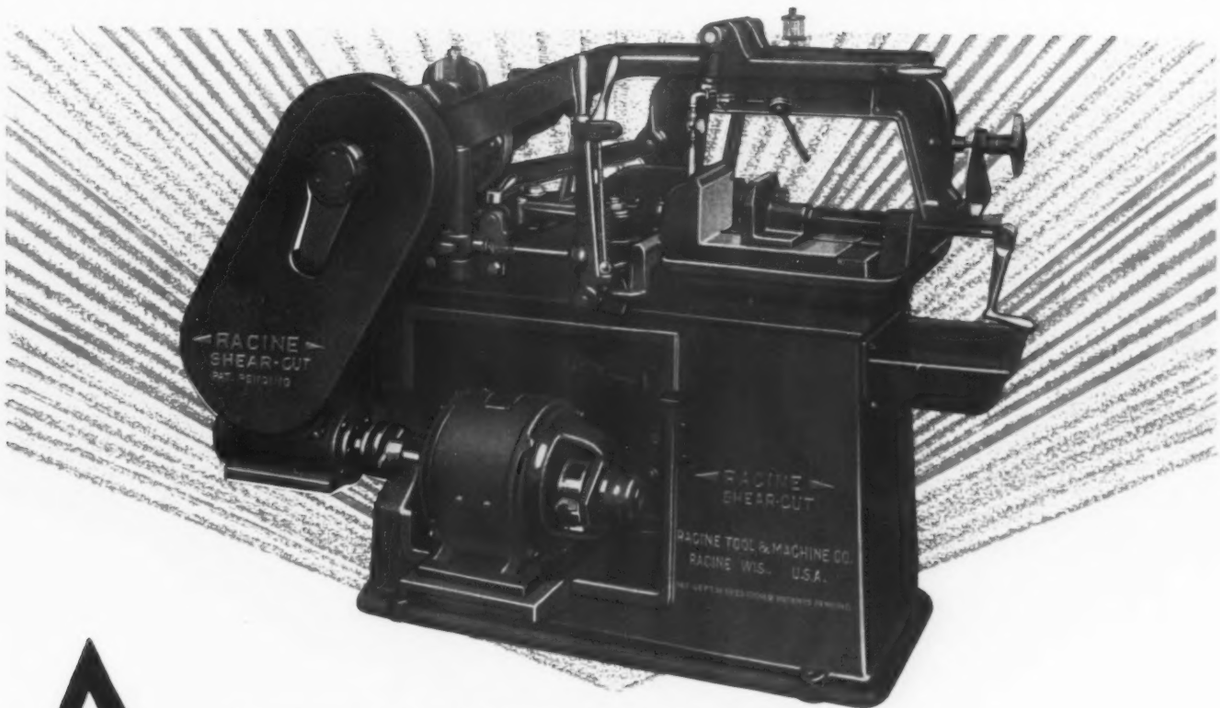
The Curtis & Curtis Co.
327 Garden St. Bridgeport, Conn.
Most Threads Per Dollar Invested

The Hurlbut-Rogers Cutting-off Machine

Will Double Your Output

Equipped with two tools, cuts twice as fast.
Made in six sizes—two types of drive.
Send for descriptive catalog.

The Hurlbut Rogers Machinery Co.
NASHUA, NEW HAMPSHIRE



A NEW DAY . . . . IN METAL CUTTING

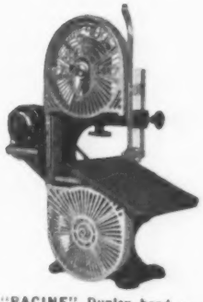
The old ways in metal cutting are a thing of the past. New methods, new machines, new principles in metal cutting equipment are here in step with the March of Progress.

Leading the way in this new era of metal cutting you see the "RACINE" Shear Cut Production saw. Backed by twenty years experience in cutting every kind of metal, this New Day Machine has set new metal cutting standards. It triples blade life—doubles cutting speed—it makes every cut, day after day in exactly the same number of minutes.

Increase your production schedules by installing the "RACINE" Shear Cut—the first and only screw feed power saw and the first to deliver constant production day after day in every kind of metal. Mail the coupon now for complete information.



The "RACINE" Abrasive metal cutter for hardened tool steels.



"RACINE" Duplex band saw —correct speeds for steel—soft metals—wood.



"RACINE" Gravity Feed machines for tool room and machine shop.

RACINE TOOL & MACHINE COMPANY
1755 State Street, Racine, Wisconsin

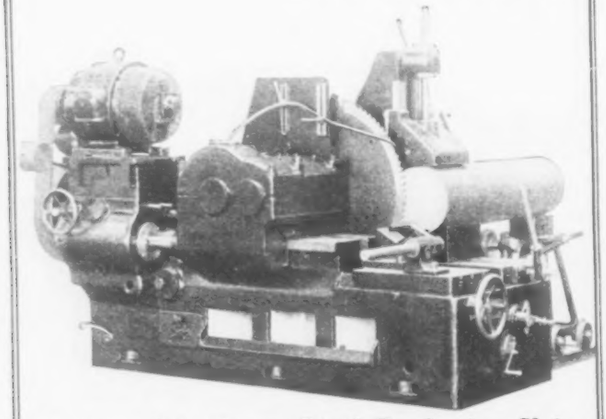
RACINE

Dept. 1755. Send me full information on the items I have checked.

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☐ Shear Cut Production Saw
☐ Duplex Band Saw
☐ Gravity Feed Machines
☐ Abrasive Cutter

The "HELLER" High Efficiency COLD SAW



A Powerful, Heavy, Rigid Production Unit for Cutting Bars, Billets, Shapes, Etc.

Seven sizes from 2¾" to 20" Capacity.

Catalog and Complete Information Gladly Furnished

STEINLE MACHINE COMPANY
MADISON, WISCONSIN

A Marvel Metal Band Saw

once installed means better results from every point of view.

Special features are: Ball bearing band wheels, guide rollers and carriage, three speeds, big bed or work table, *new feed* that registers the *blade pressure* in *pounds*, and many others.

Capacity up to and including 18 inches.

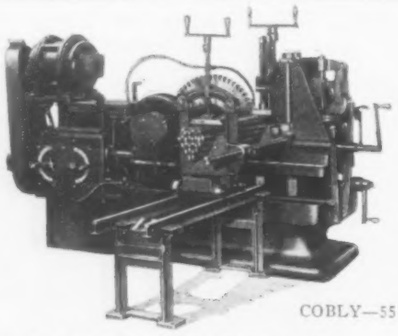


Write for complete description and big list of users

The Marvel Metal Band Saw No. 8 can be adapted to all kinds of sawing jobs, large or small. It cuts off square or at any angle, right or left, up to 45 degrees. It is a standard tool in the best shops everywhere.

Armstrong-Blum Mfg. Co. 349 N. Francisco Ave., Chicago, Ill.

CUTS 1000 ONE INCH PINS PER HOUR



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COCHRANE—BLY CO.
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Twist Drills—Hobs Milling and Gear Cutters Reamers—Carbon or High Speed Steel

Specialists in laying out and designing Cutters for production work.

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Band Saws, Saw Tables, Self Feed Rip Saws, Shapers, Jointers, Variety Wood Workers, Planers, Planers and Matchers, Disk Grinders, Cut Off Tables, Swing Saws, Borers, Hollow Chisel Mortisers, Tenoner, Universal Woodworkers.

THE CRESCENT MACHINE CO., 77 MAIN STREET, LEETONIA, OHIO

MURCHEY Self-Opening Non-Rotating **Die Head**

Especially adapted to precision work. Chasers easily removed without taking off cap. Write for details.

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Cutting-Off Machines

—for thin and thick wall steel tubing and bars

BARDONS & OLIVER
Cleveland, Ohio

We also manufacture a large line of turret machinery for finishing cast iron, steel and brass

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Divine Brothers Company
Utica, N. Y., U. S. A.
Abrasive Metal Finishing Engineers



More Drilling- Fewer Drills

In the tool crib it's just another piece of metal — weighing so much, costing so much. In the chuck, with the feed on, it plays a vital part of the vital purpose of industry — production.

The Morse Line includes:

DRILLS
REAMERS
CUTTERS
TAPS AND DIES
SCREW PLATES
ARBORS
CHUCKS
COUNTERBORES
MANDRELS
TAPER PINS
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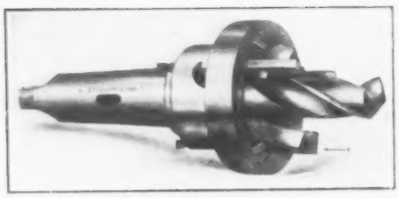
Judge drills by their importance in your production, and you will know why the best are least expensive for you. Your production figures will show more drilling with fewer drills if you use MORSE.

MORSE

TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASS., U.S.A.

Shops that once use Brubaker





BRUBAKER TOOLS

Dies
Hand Taps
Tapper Taps
Crown Stay Locomotive Taps
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Tap Wrenches

Chucking and Hand Reamers
(Solid or Inserted Blades)
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Flexible Staybolt Taps
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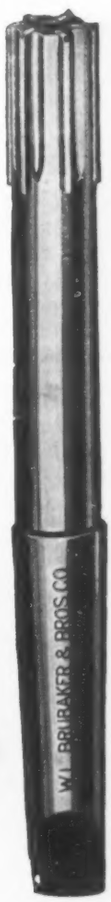


Small Tools Seldom Change



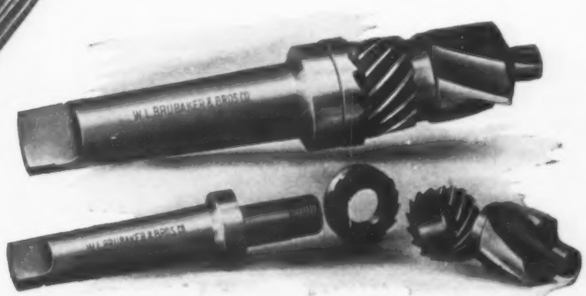
And some shops have been using Brubaker Small Tools for over 40 years! The reason for this remarkably consistent patronage of these tools lies in the fact that they have a greater degree of accuracy, an exceptionally long life, and give longer production runs between grinds.

Brubaker Small Tools are made of the finest steel possible to buy. They are uniformly tempered and each must undergo a minute individual inspection. Yet, their first cost is no more than tools of lesser merit while their ultimate cost is considerably less.

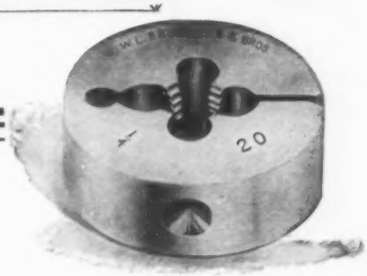


If you are not already using them, we urge you to give them a trial.

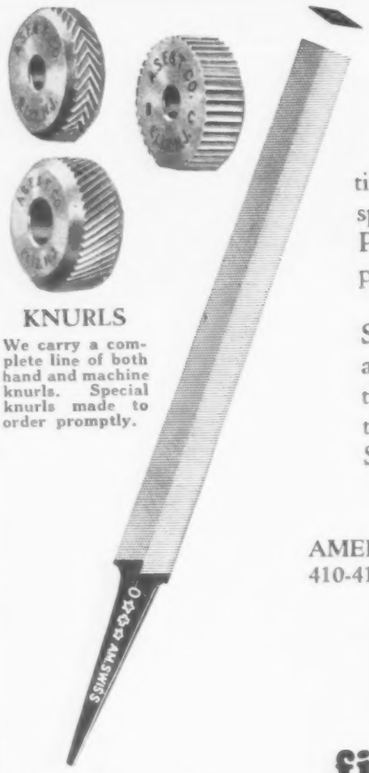








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We carry a complete line of both hand and machine knurls. Special knurls made to order promptly.

2400 different sizes, shapes and cuts to choose from.

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The longer life of American Swiss Files, the better filing results and lower filing costs resulting from their use, have added materially to the profits of many an American Swiss File user.

May they add to yours in 1930!

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ONLY THE BEST

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also manufacturers of American Swiss Mechanics' Hand Tools.

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If It Is a Precision Screw Thread Geometric has a Tool for the Job



Class SJ

Stationary Self-Opening Die Heads—10 distinct standard types—a tool especially adapted for every machine and most any job.

Rotary Self-Opening Die Heads—2 types offering either Spool or Button trip as you prefer.

Solid Adjustable Die Heads.

Collapsing Taps—A universal tool quickly adapted to most any standard machine.

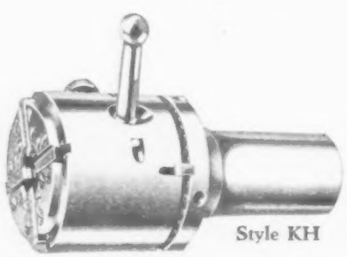
Solid Adjustable Taps.

Receding Chaser Taps

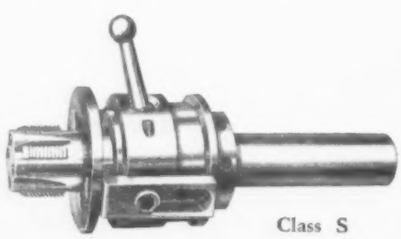
Threading Machines and Chaser Grinders also



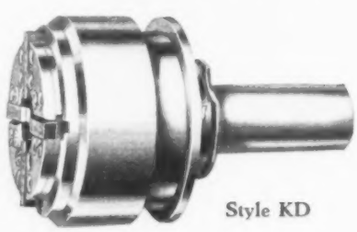
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Style KH



Class S



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THE GEOMETRIC TOOL COMPANY

New Haven, Conn.

The world's largest exclusive producer of Self-Opening Die Heads and Collapsing Taps



The "BOOK OF THE YEAR"

FOR

Designers ▲
Engineers ▲
Draftsmen ▲

THE Threaded Part Data Book, compiled and offered by The Eastern Machine Screw Corporation, manufacturers of H & G Die Heads, contains sixty pages packed with information and suggestions that will lead to definite savings in production.

Every page represents years of collective experience from which only the best and most helpful has been culled. It is a book which every designer, engineer and draftsman should have . . . that should be in every manufacturing department.

Just a glance at the table of contents shows the multitude of subjects covered. The Threaded Part Data Book will prove itself useful every working day. No one interested in machine design of any type should be without this book.

A limited number of these valuable books are available free. You may have your copy by filling out the coupon, or sending us your name on your business letterhead.

Look at this Table of Contents

Suggestions for Design of Threaded Parts.
List of Stockable Chaser Sizes for Die Heads.
Definition of Thread Elements.
American National Form of Thread.
American National Coarse and American National Fine Thread Series.
Notes on Special Diameters and Pitches.
Special 12 Pitch Series.
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Whitworth Pipe.
British Association Thread.
French and International Standard Threads.
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Decimal Equivalents of Fractions of Inches.
Cutting Speeds in Feet per Minute for Different R.P.M.'s.
Net Production Chart Giving Gross and Net for Different Seconds to Make.
S.A.E. Standard Chemical Composition of Steels with S.A.E. Numbers.
Weight Per Foot, Cold Drawn Steel Stock.
Standard Practices and Conditions of Sale for Screw Machine Products.
Questions to ask when selecting a Die Head.
Sizes and Physical Dimensions of H & G Die Heads.
H & G Chaser Grinder.
H & G Threading Machine.
How to Order Die Heads and Chasers.

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NEW HAVEN, CONN.

COUPON
EASTERN MACHINE SCREW CORP.,
NEW HAVEN, CONN.

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Please send me my copy of the Threaded Part Data Book. This, of course, places me under no obligation.

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Position .....
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(Selected for the Byrd Expedition to the South Pole—dependable, efficient)



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Morrison Machine Co.
Paterson, N. J.

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There are no characteristics more important to machine tools than general adaptability and absolute dependability. These are characteristics always found in ARMSTRONG Tool Holders. They are designed and proportioned on lines which our many years of experience as specialists in this field have shown to be correct, they are drop forged from special steel which combines stiffness and strength to an extreme degree and are accurately machined, heat treated and hardened. The set screws are made of treated alloy steel with hardened points and are practically unbreakable.



ARMSTRONG
Spring Threading Tool
Easily adjusted. Resilience assures a smooth finishing cut or thread even on the toughest alloy steels. Cutter can be set at three angles.

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Lathe Dogs
"C" Clamps
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Stocks and Dies
Chain Pipe Tongs
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Getting More Production From Your Portable Grinders

With Vulcanite high speed wheels on your Portable Grinders you can count on greater production from these tools. These efficient, fast cutting wheels not only remove more stock but leave a smooth finish on the work. There is a type wheel for every kind of a job, including straight wheels, cone wheels and cup wheels and a suitable grade and grain for the different metals as follows:

For steel castings, welds and billets use Vulcanite Wheel 14-150-S.

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Prompt shipments from stock.

NEW YORK BELTING & PACKING CO.

91-93 CHAMBERS ST., NEW YORK

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VULCANITE *Grinding Wheels*

Bonded with Rubber

Great Plants Where



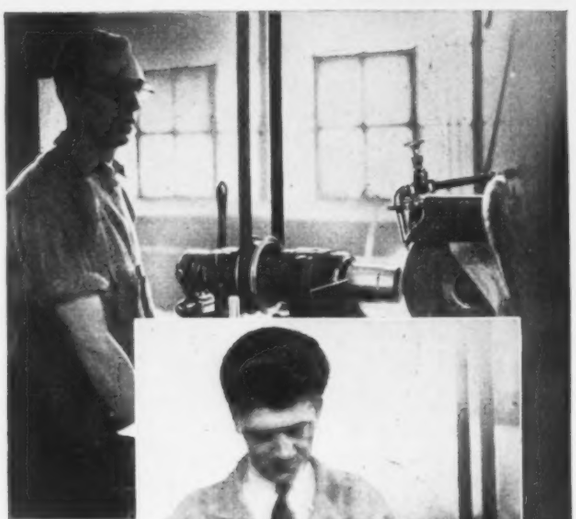
In our line of manufacture—automobile and airplane valves, bolts, steel bushings and other hardened and ground parts made to exceedingly close limits—the trend is more and more toward the use of complex alloy steels. The greater tensile strength, toughness and other characteristics of such steels have necessitated radical changes in our equipment and methods. These changes have favored the wider application of abrasive products to operations on which we formerly employed straight machining methods.

¶Such changes have resulted in faster production, more uniform work and a degree of accuracy not readily obtainable heretofore.

¶I believe that abrasive products have come into their own in plants like ours and that they have become of immense value to American industry in the reduction of manufacturing costs and the improvement of quality.

E. A. McBRIDE,
Factory Manager,
Thompson Products, Inc.





A Grinding Machine Operator using Aloxite Brand Wheels in Grinding the Tops of the Thompson Valve Heads



The Grinding of the Retainer Grooves is done, as illustrated, with Aloxite Brand Improved Internal Grinding Wheels

(CARBORUNDUM AND ALOXITE ARE THE REGISTERED TRADE MARKS OF THE CARBORUNDUM COMPANY FOR ITS PRODUCTS)

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Products, Inc.





Here they use Aloxite Brand Wheels in the Accurate Centerless Grinding of Valve Stems



Grinding the Seats of Valves with Aloxite Brand Wheels

It is indeed significant that in the plant of Thompson Products, Inc. at Cleveland, Ohio—the world's largest producers of Motor Engine Valves—Carborundum and Aloxite Brand Grinding Wheels are regarded as among their most necessary production tools.

¶Over one hundred thousand valves a day are produced in this plant. Thompson Valves are "at the hearts of the motors" in over one hundred makes of motor cars, tractors, airplanes, marine engines, as standard equipment.

¶The maintenance of extreme accuracy, speed of production, economy in wheel costs, intelligent grinding service and the ability to help in the upholding of Thompson standards of quality have earned a welcome for Carborundum-Made Grinding Wheels in this great plant.

Niagara Falls, New York, U. S. A.

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"When there's a lot of metal to grind off, I give the job to this high speed wheel" *Tom Grinder*



For more than a year "Tom Grinder" has been checking the advantages of high speed grinding equipment and wheels in a plant where the steel castings come through with a lot of metal to be removed. With these new wheels, running safely at 9,300 surface feet per minute, instead of the usual five or six thousand feet, he found that the operators remove a greater amount of metal with less pressure and consequently less fatigue.

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Abrasive wheels bonded with resinoids made by Bakelite Corporation are produced by all the leading manufacturers. Names on request.

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THE Safety Grinding Wheel and Machine Company has been tackling the problems of the grinding industry for 38 years, "taking all comers." How well the job has been done is reflected in the dominance of SAFETY equipment in the field today . . . grinding wheels and machinery which do cut operating costs and increase profits for our customers.

The remarkable SAFETY "Rite-Speed" Grinder embodies one feature which alone is sufficient to place it far in the lead. The exclusive changeable speed device automatically *enforces* the grinding wheel speed to be increased as the wheels wear down . . . and this with a constant speed motor. This grinder will pay for itself in a few months' time by savings in wheels and by increased efficiency of operation.

SAFETY originated motor-driven Portable Grinders and developed a variety of models . . . each one perfectly balanced and giving a full 90° roll in either direction. The new SAFETY "De Luxe" Portable Grinder has been especially designed and built for high-speed work with organic-bonded wheels. Whatever model is used, these versatile grinders show a positive profit in grinding bulky and unwieldy pieces.

The SAFETY line also includes Motor- and Belt-Driven Floor Grinders, Wet Tool Grinders, Surface Grinders and Buffing Lathes. All are built in conformance with the SAFETY creed of lower grinding costs.

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SAFETY Grinding Wheels have been developed for slow, moderate and high-speed grinding . . . wheels for gray and unannealed malleable iron, annealed malleable iron, steel, copper and other metals. SAFETY Wheels are available for *any* job, in any grain or grade, size or shape . . . either from stock or made to your individual specifications.

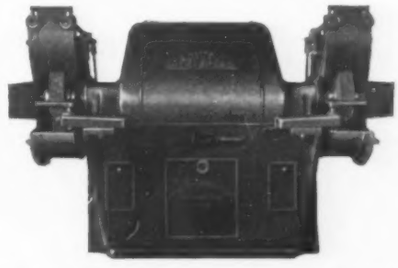
The "Safe-T-Bond" Wheel (bakelite bonded) has contributed in no small measure to the development of modern high-speed grinding. It is without an equal for such work.

Send for Full Information

Learn the facts about the "Rite-Speed" and "De Luxe" Portable Grinders . . . how they cut costs and increase profits. Find out about "Safe-T-Bond" high-speed wheels. Use the convenient coupon *today* to find out how SAFETY equipment pays for itself . . . and can pay extra profits to *you*.



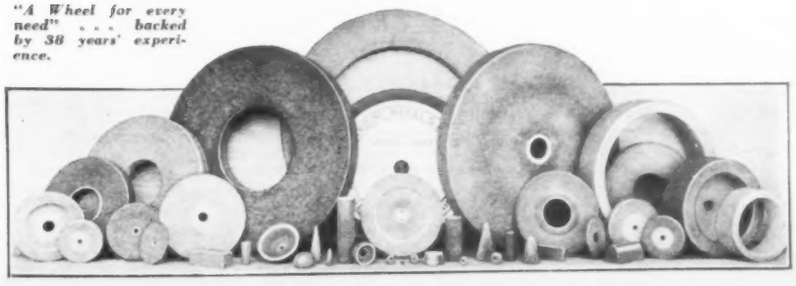
The new SAFETY "De Luxe" Portable Grinder, for high-speed work with organic-bonded wheels, stops spoilage losses by allowing perfect visibility; saves hours of time by extreme ease of changing wheels; maintains efficient grinding speeds by its patented "Interlock". Send for Bulletin S-29-3.



The "Rite-Speed" Grinder automatically enforces the correct surface speed for maximum grinding efficiency as the wheel wears down. It is engineered and built to meet the needs of modern high-speed grinding. Bulletin F-28-3 gives complete file data.

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"A Wheel for every need" . . . backed by 38 years' experience.



The Safety Grinding Wheel and Mach. Co.,
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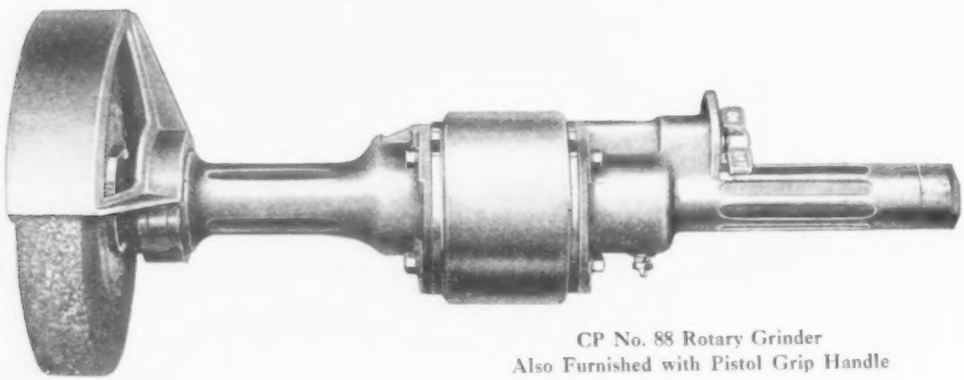
We want to see the proof. Send complete information about

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SAFETY "De Luxe" Portables
"Safe-T-Bond" High-Speed Wheels.

(Name of individual)

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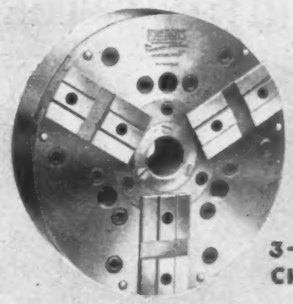
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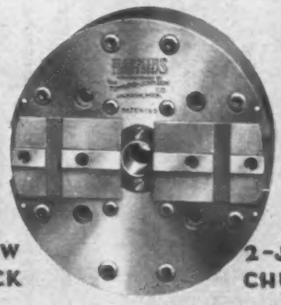
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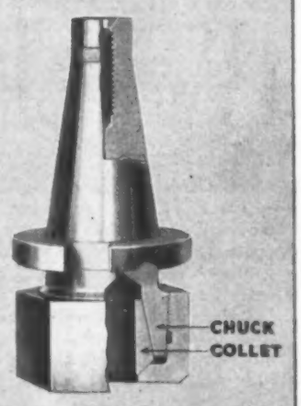
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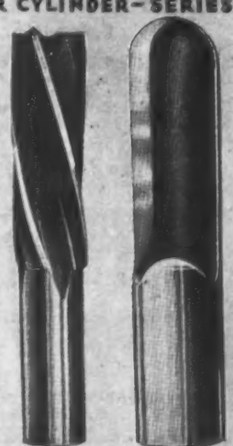
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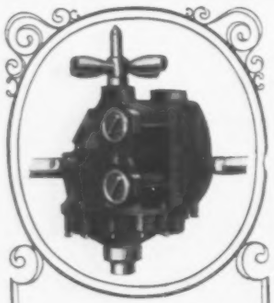


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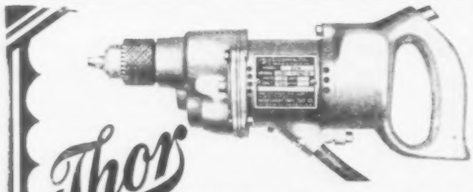
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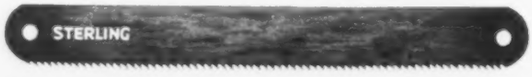


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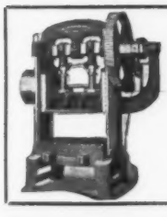
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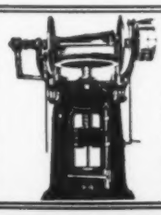
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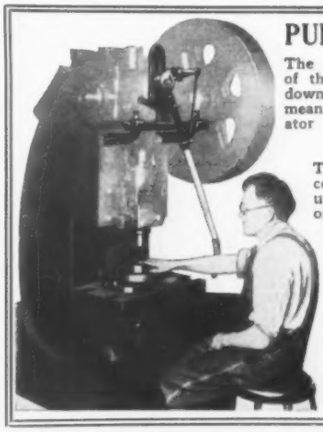
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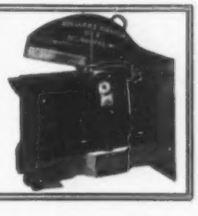
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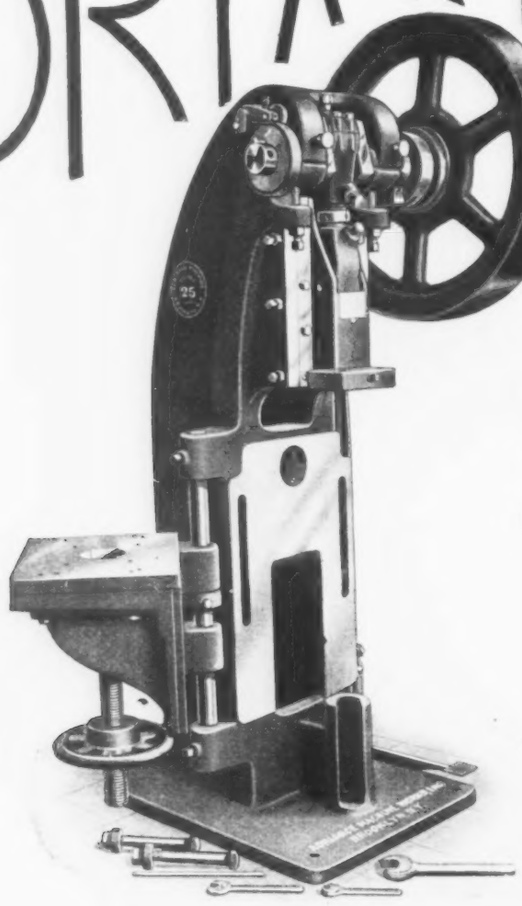
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THIS type of press will be found useful where large space is required between bed and slide, the adjustable table allowing the use of dies of extra height. Adaptable for the various operations of Horning and Wiring, for grooving or closing the side seams on round, square or oval cans and for operating wiring dies. Also for blanking, combination and forming die work.

Double Bumping Horns for closing the two side seams of 5 gal. cans, at one operation, may be attached to these presses.

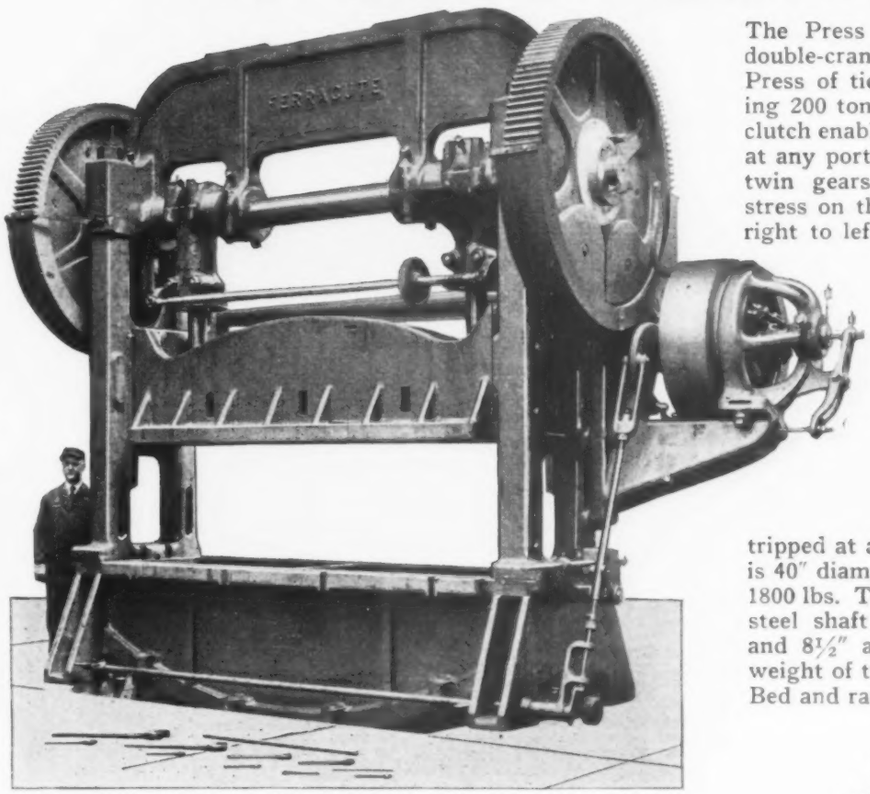
ADRIANCE MACHINE WORKS, INCORPORATED

82 Richards Street Brooklyn, N. Y.

Please send Bulletin No. 6 with information regarding
Power Punching Presses, Horning & Wiring Presses

Name ..... *City* ..... *State* .....

FERRACUTE PRESSES
FOR METAL STAMPINGS



Press S 208

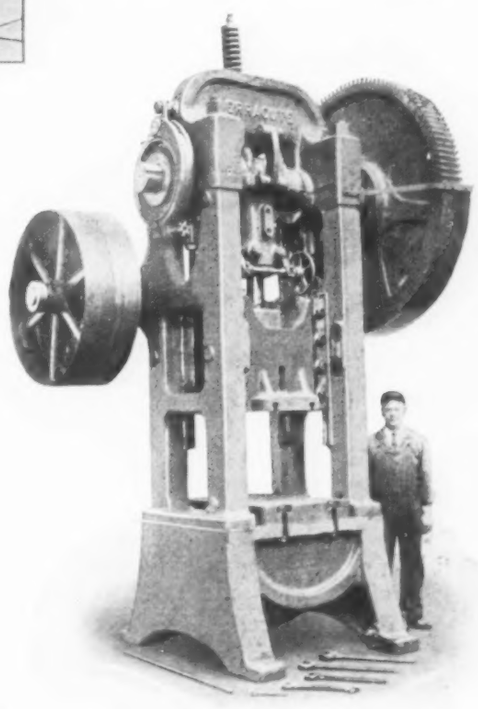
The Press S208, at the left, is a double-crank, twin-geared Stamping Press of tie-rod construction exerting 200 tons pressure. The friction clutch enables the press to be started at any portion of its stroke and the twin gears equalize the torsional stress on the main shaft. Distance right to left between columns 124". Wider and narrower presses are built.

Press contains ram-balance, wheel guards, bronze-bushed bearings, motorized ram-adjustment and a treadle-shaft extending the entire length of the machine enabling clutch to be tripped at any point. The fly wheel is 40" diameter, 12" face and weighs 1800 lbs. The diameter of the forged steel shaft is 7½" at the journals and 8½" at the crank. The total weight of the press is about 50 tons. Bed and ram are heavily trussed.

THE single-action press of tie-rod construction at the right exerts 200 tons pressure. It contains a jaw-clutch, ram balance, bronze bushed bearings, gear-guard and ram-knockout. The tie-rods are shrunk in the columns. Facilities provided for motorizing ram adjustment and running press by motor-power either direct or by belt.

Ferracute Presses are made in many sizes and styles. Specifications and photographs promptly furnished on receipt of samples or drawings of work contemplated. They are up to the minute in design and construction. Thousands of Ferracute Presses in varied industries testify to the policy of always being in the van guard.

Special Agents: Detroit, Welker Machinery Co.; Chicago, Neff Kohlbusch & Bissell.; Cincinnati and Indianapolis, The E. A. Kinsey Co.; San Francisco and Oakland, Flanagan Machinery Co.; Los Angeles, Shaw-Palmer-Bakewell Co.



Press DG 58

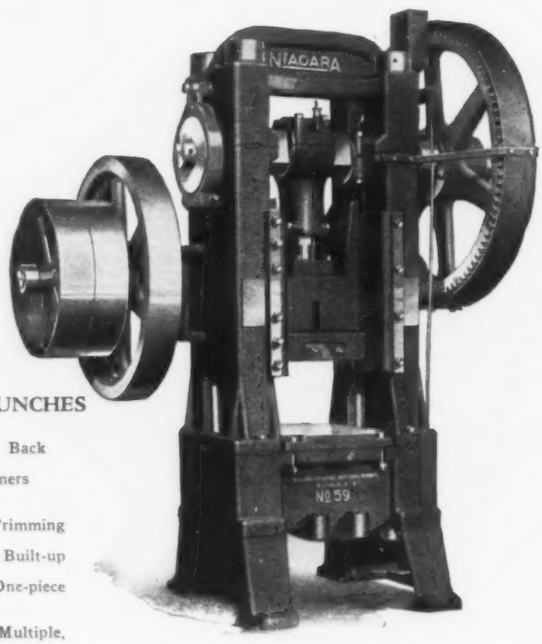
FERRACUTE MACHINE COMPANY, Bridgeton, New Jersey

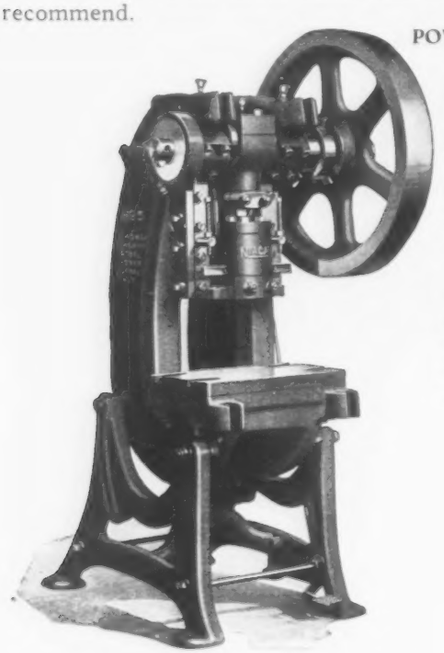
NIAGARA

MACHINES, TOOLS AND DIES FOR SHEET METAL WORK

DESIGNING and building machines and tools for working with sheet metal has been the business of this company for over fifty years. Our products are characterized by original engineering design and the highest skill in manufacture, giving closer accuracy and increased output at lower cost.

For the users' greater convenience complete information on types, construction and capacities of machines is given in separate numbered bulletins. Send for any or all Bulletins that interest you or write what you have or wish to form from sheet metal and our engineers will recommend.





POWER PRESSES AND PUNCHES

Bulletin
58 Inclinable Presses, Open Back
59 Power Bench Press
60 Horn Presses—Side Seamers
61 Punching Presses
62 Arch Presses
63 Single Crank Presses, Trimming Presses
64 Double Crank Presses, Built-up Frame
65 Double Crank Presses, One-piece Frame
66 Double Action Presses
67 Power Punches, Single, Multiple, etc.
68 Foot Operated Presses

POWER SQUARING SHEARS

Bulletin
71 Power Squaring Shears, Light
72 Power Squaring Shears, Medium
73 Power Squaring Shears, Heavy

POWER ROTARY SHEARS

Bulletin
70 Power Circle Shears
70 Power Ring Shears
70 Power Flangers

SHEET METAL SHOP MACHINES AND TOOLS

Handy Reference Catalog No. 56 describes the smaller machines and tools for the sheet metal shop.

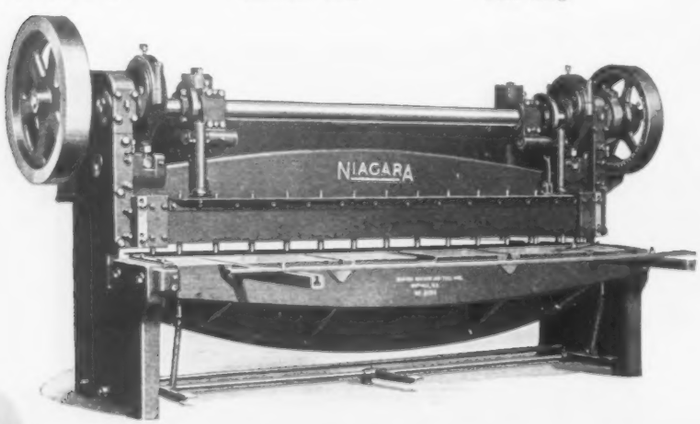
SPECIAL EQUIPMENTS, ENGINEERING SERVICE

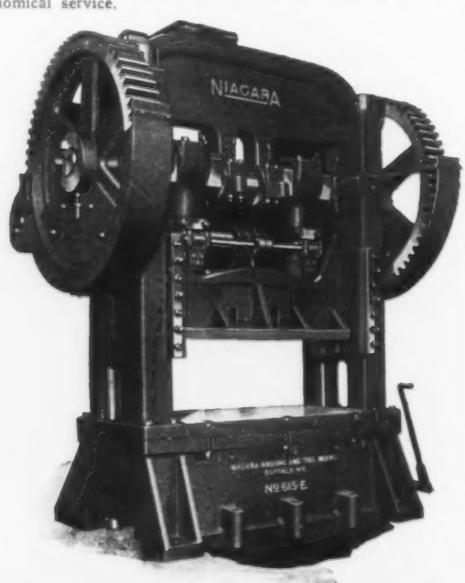
We make special machines and arrangement of our regular and special machines for the manufacture of a large number of sheet metal products.

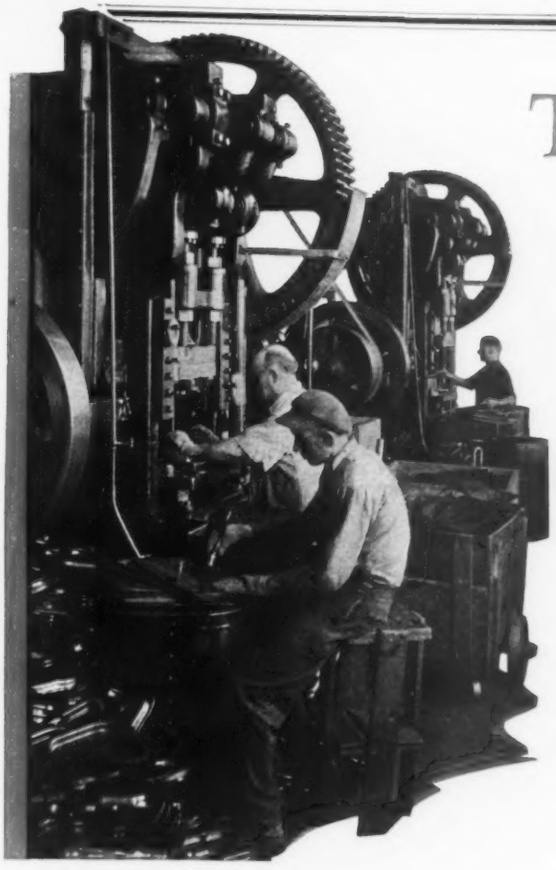
DIES AND FEEDS

A corps of die designers and makers with a wide experience in press and die work devote their entire time to the production of dies and feeds to give long and economical service.

NIAGARA MACHINE & TOOL WORKS
637-697 Northland Ave., Buffalo, N. Y.
New York City 50 Church St.
Philadelphia Elverson Bldg.
Pittsburgh Park Bldg.







There's a BLISS for every PRESS requirement

NO matter what your requirements in sheet metal punching, piercing, blanking, embossing, stamping or forming, there is a BLISS that will give you satisfaction. This assurance is not qualified as regards material, quantity, size or shape of your requirements.

In the thousands of BLISS installations on work of every conceivable nature is ample proof that there is a type that will provide you with a most efficient means of production on any sheet metal job.

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

Sales Offices

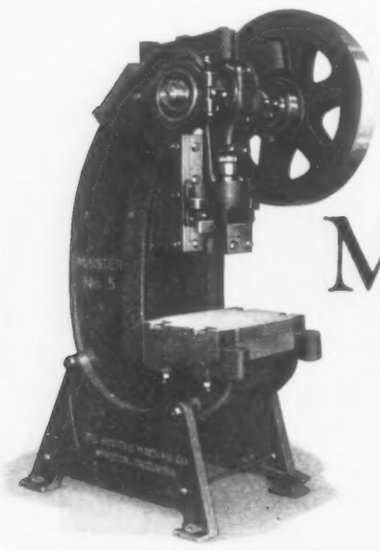
DETROIT Gen. Motors Bldg. | CLEVELAND Guarantee Title Bldg. | CHICAGO 1900 N. Kilbourn Ave. | CINCINNATI Union Trust Bldg. | ROCHESTER Times Union Bldg. | NEW HAVEN 2d Nat. Bk. Bldg. | BOSTON Weld Bldg. | PHILADELPHIA Nat. Bk. of N. Phila. Bldg.

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Foreign Sales Offices and Factories

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WHAT DO YOU THINK OF WHEN YOU BUY A PRESS?

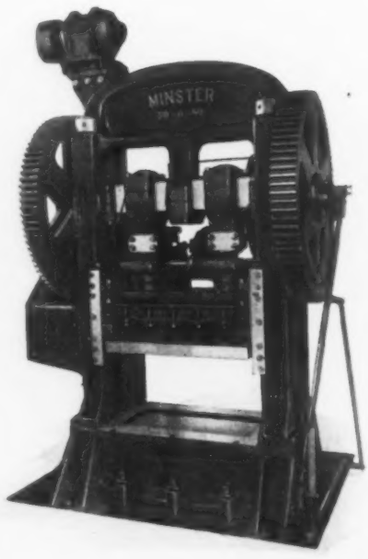


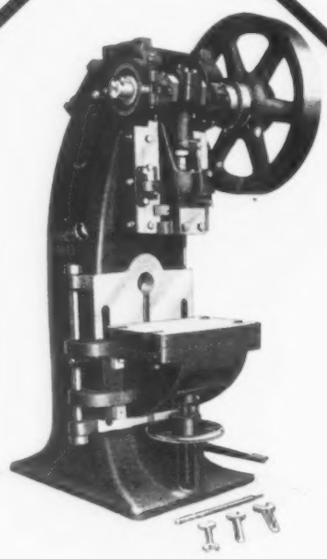
This is what

MINSTER

tells you to think of:

THE CLUTCH
THE BEARINGS
THE LUBRICATION





The Strength of:

THE CRANKSHAFT
THE FRAME
THE FLYWHEEL
THE GEARING

The Quality of:

THE DESIGN
THE MATERIALS
THE WORKMANSHIP

YOU have the right to judge a press by its reputation for reliability and its yield in productive service. When you consider this sound method of evaluating presses, price becomes a relative matter

INCLINABLE - HORNING - STRAIGHT SIDE - PUNCHING
KNUCKLE - JOINT - GAP - AND SCREW PRESSES

THE MINSTER MACHINE CO.

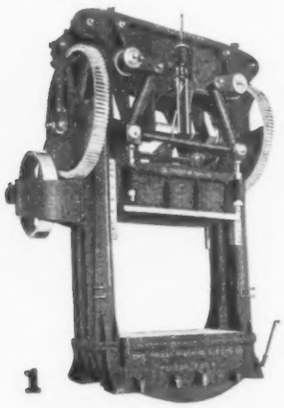
MINSTER, OHIO, U. S. A.

CHICAGO OFFICE
549 W. Washington Boulevard

"Toledo" Presses FOR EVERY PURPOSE

DETROIT OFFICE
3-258 General Motors Building

OVER TWO THOUSAND PATTERNS FROM WHICH TO CHOOSE


1

1 THE "TOLEDO" DOUBLE CRANK TOGGLE DRAWING PRESSES—Series No. 700. Built in many sizes up to 450,000 lbs. Smoothness of action, perfect timing, and economy of floor space. For deep stamping, drawing and forming operations of automobile bodies, etc. Toggle arms and levers of steel. See "Toledo" Catalog, Section No. 8-A.

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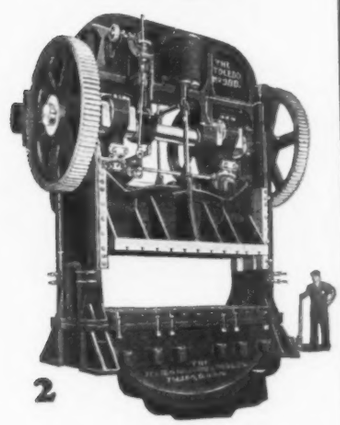
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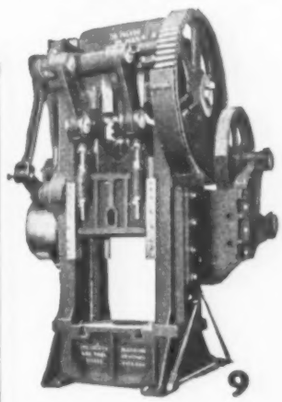
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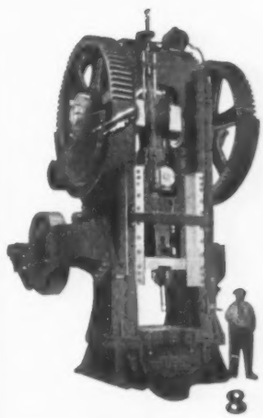
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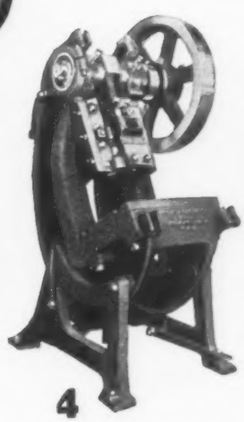
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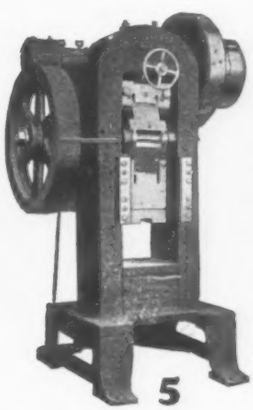

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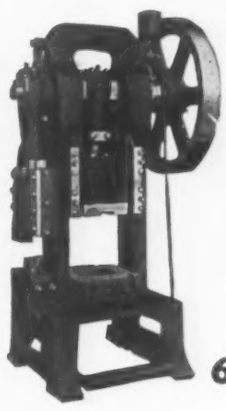

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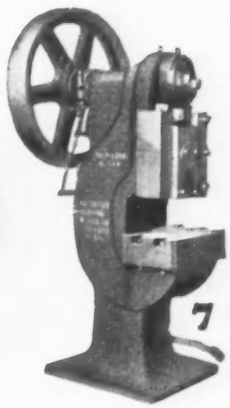

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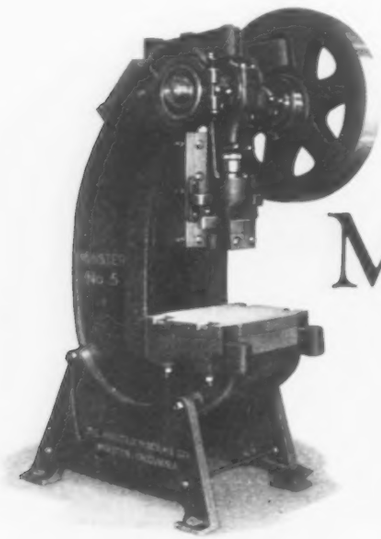

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7

THE TOLEDO MACHINE & TOOL CO., Toledo, Ohio, U. S. A.

Engineers, Founders and Machinists on equipment for sheet metal products

WHAT DO YOU THINK OF WHEN YOU BUY A PRESS?

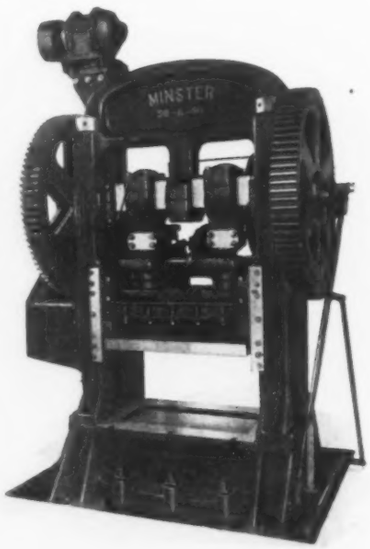


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MINSTER

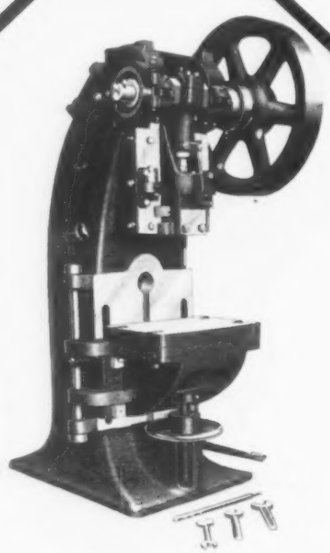
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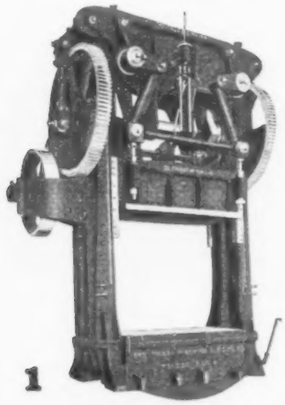
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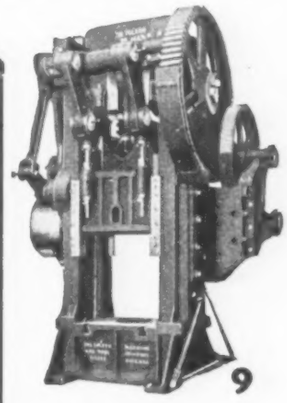
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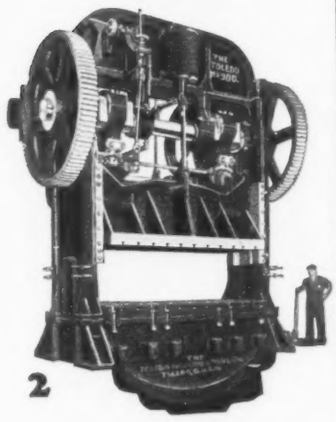
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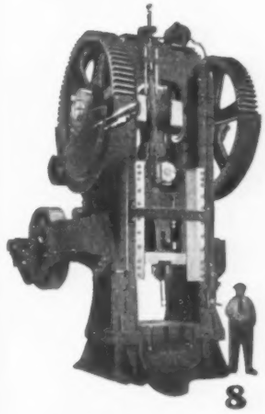
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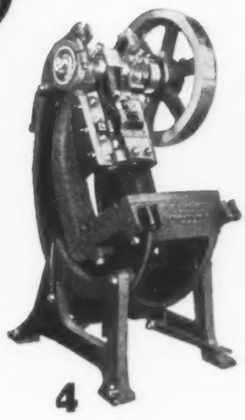
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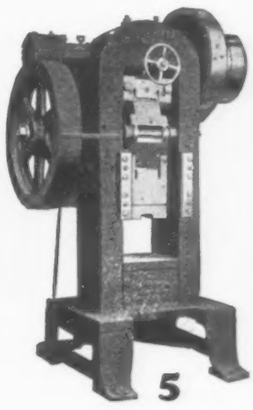

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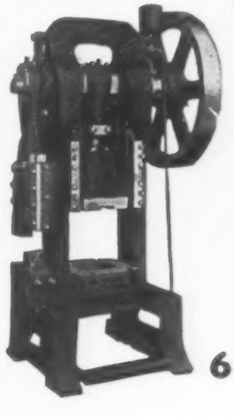

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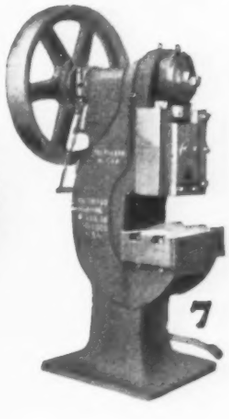

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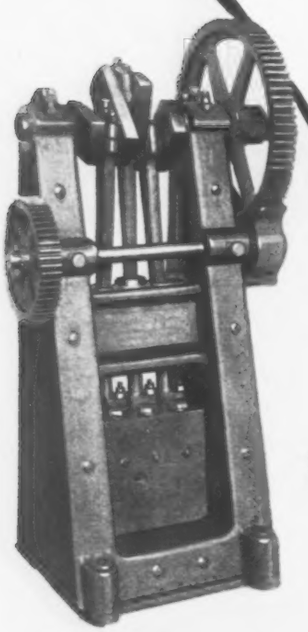
Press your scrap

Production managers who are constantly seeking ways and means of reducing operating and maintenance costs, will readily see the possibilities of extra profits, offered by Galland-Henning Compresses and Balers. Compressed scrap not only has a greater market value, but requires less storage space, makes a neater appearance and reduces handling cost.

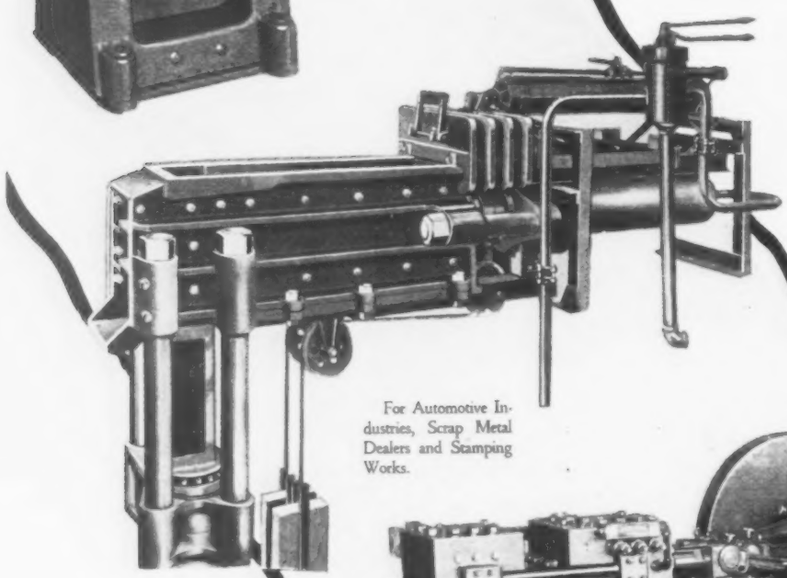
To obtain the desired results, proper equipment is necessary. You must take into consideration the following points:

One—The type of bale produced. It must be tight, compact, uniform —every bale alike.

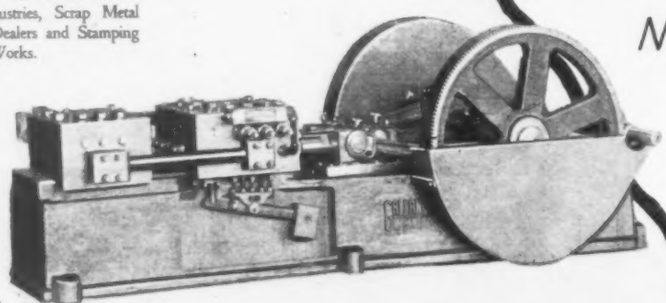
Two—The design of the machine for economical operation and maintenance.



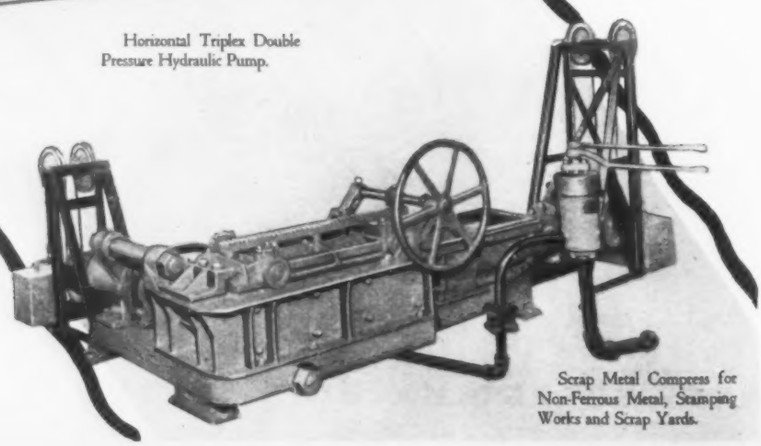
Vertical Triplex Single Pressure Hydraulic Pump.



For Automotive Industries, Scrap Metal Dealers and Stamping Works.



Horizontal Triplex Double Pressure Hydraulic Pump.



Scrap Metal Compress for Non-Ferrous Metal, Stamping Works and Scrap Yards.

GALLAND-
MANUFACTURING
MILWAUKEE

into extra Profit

Galland-Henning line includes many types of balers and compresses—All Steel Hand Balers—Toggle-Type Baling Presses—and powerful Hydraulic Compresses, with bale capacities ranging up to 1100 lbs.

These machines have proved through years of actual service their superiority over the conventional types. Modern design—rugged superconstruction—low maintenance cost—efficient—safe—save floor space—give extra profits—always on the job, and last almost indefinitely.

Other very interesting features are shown in our booklet which will be sent on request.

Consult us about your problems.

HENNING
COMPANY
WISCONSIN



For Paper Mills, Waste Material Dealers, Department Stores, Textile and Printing Plants.

For Paper Mills, Waste Material Dealers, Box Manufacturing Industries, Leather, Rubber, etc.

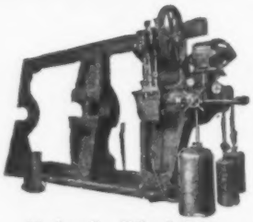
For Manufacturers of Bags, Overalls, Piece Goods, etc.

For Small Offices, Stores and Homes.

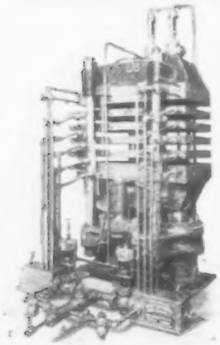
SOUTHWARK
HYDRAULIC PRESSES
for every operation
HYDRAULIC PUMPS, ACCUMULATORS,
OPERATING VALVES, ETC.
SPECIAL MACHINERY



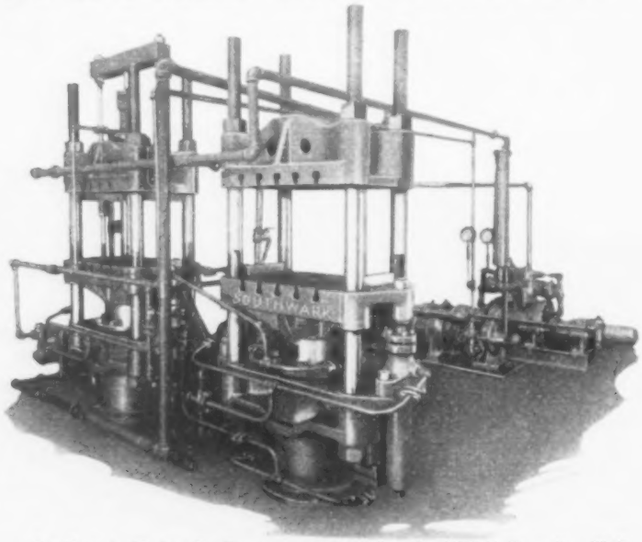
Hydraulic Accumulators



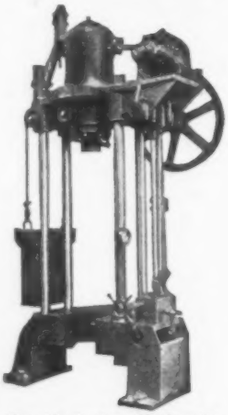
Hydraulic Wheel Press



Press for Making Safety Glass



Southwark Hydraulic Presses operated by the HYLO Pumping Unit

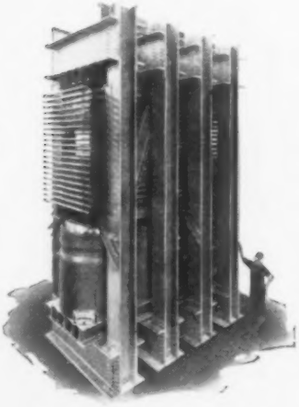


Rapid Action Hydraulic Bushing Press

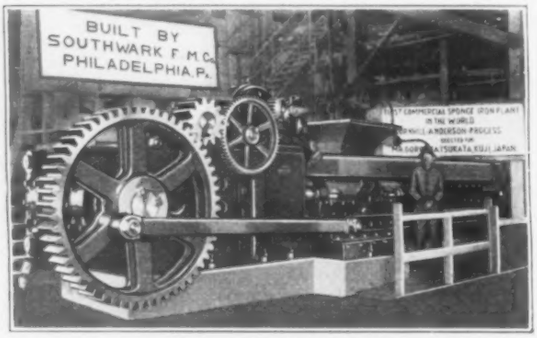


2000 Ton Grinding Wheel Press

The HYLO-PUMPING UNIT
GIVES ANY PRESSURE *from* ZERO
to MAXIMUM CAPACITY *without the*
USE *of* ACCUMULATORS.
The most modern method of operation.

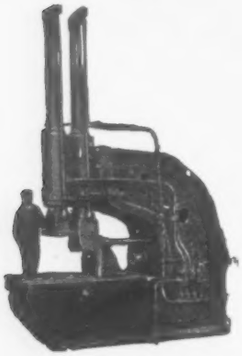


4'x12' Wall and Insulating Board Press



Southwark 300 ton Briquetting Machine. This machine makes briquettes from cast iron chips, the product is 80% as dense as solid iron. Used by the following firms:

Dodge Bros., Inc., Detroit, Mich. (One)
G. Matsukata Co., Kuji, Japan. (Two)
National Tube Co., Lorain, Ohio. (One)
Oakland Motor Car Co., Pontiac, Mich. (One)
General Reduction Co., Detroit, Mich. (One)
Packard Motor Car Co., Detroit, Mich. (Two)
Buick Motor Car Co., Flint, Mich. (One)
Wilson Foundry and Machine Co., Pontiac, Mich. (One)
Timken Roller Bearing Co., Canton, Ohio. (Two)
John Deere Tractor Co., Waterloo, Iowa. (One)



Hydraulic Sectional Flanging Press



Hydraulic Riveters

SOUTHWARK
FOUNDRY AND MACHINE CO.
ESTABLISHED 1836
PHILADELPHIA, PA.

CHICAGO
343 S. DEARBORN ST.

400 WASHINGTON AVENUE PHILADELPHIA, PA.

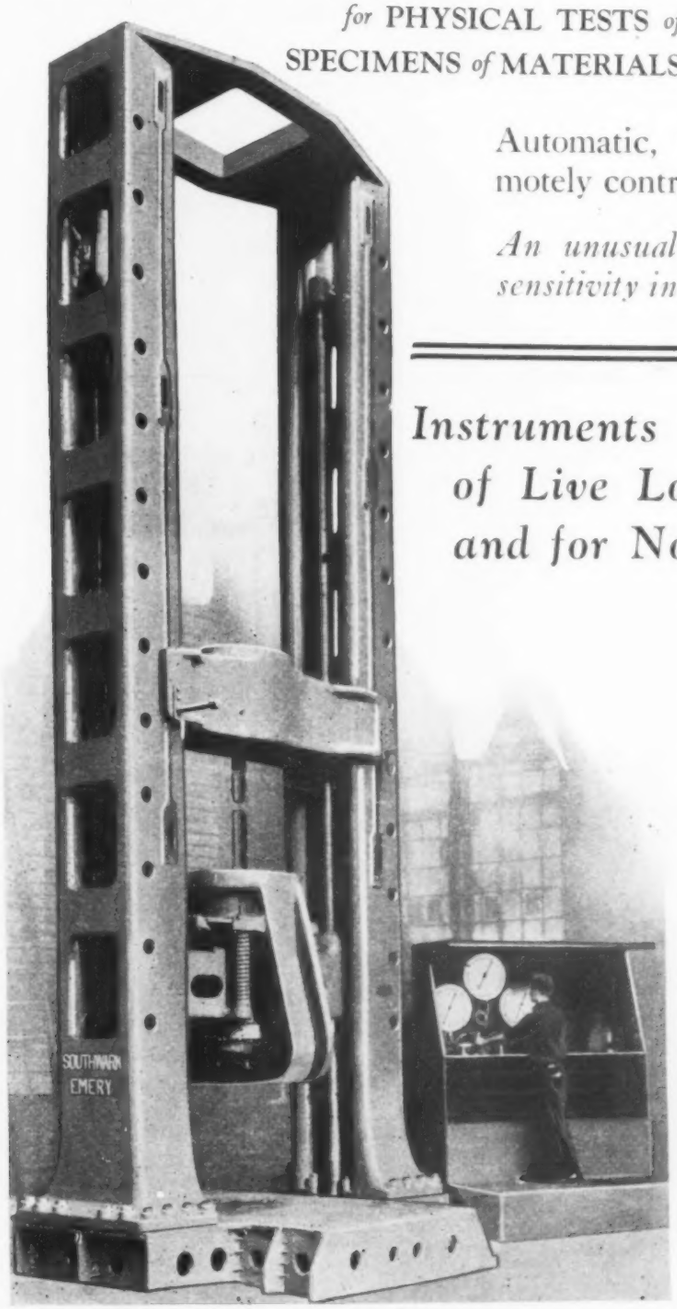
AKRON
UNITED BLDG.

SOUTHWARK-EMERY
UNIVERSAL HEAVY DUTY TESTING MACHINES

for PHYSICAL TESTS *of the* LARGEST *and* SMALLEST SPECIMENS *of* MATERIALS *and of* FULL SIZE STRUCTURES—

Automatic, Self-indicating, Recording, Remotely controlled, Quiet and Fool proof.

An unusual example of great accuracy and sensitivity in massive machines.



Southwark-Emery Universal Testing Machine.
Capacity, One Million Pounds

Instruments for the Measur ment of Live Loads and Pressure and for Non-Destructive Testing—

The McCollum-Peters Electric Telemeter.

The Electric Engine Indicator.

The Whittemore Strain Gage.

The Huggenberger Tensometer.

The Beggs Deformeter for design and tests by use of elastic models.

Each of the above is covered by a special booklet, sent on request.

A combined Catalog and Technical Discussion of Testing Equipment and Methods is now ready

SOUTHWARK
FOUNDRY AND MACHINE CO.
PHILADELPHIA, PA

Represented in Middle West by
STEEL CITY TESTING LABORATORY
8843 LIVERNOIS AVENUE, DETROIT, MICH.

ROCK RIVER ENGINEERING CO.

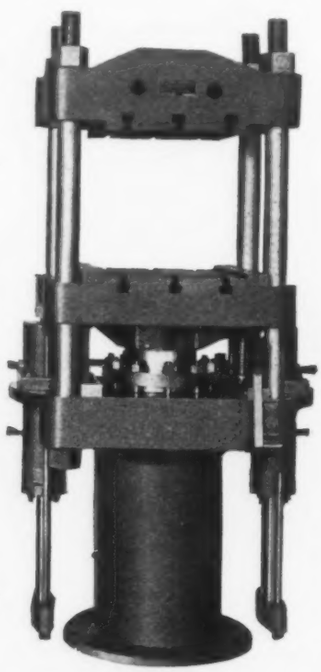
Operating The New Doty Mfg. Co.

Hydraulic Machinery
Plate and Structural Working Tools

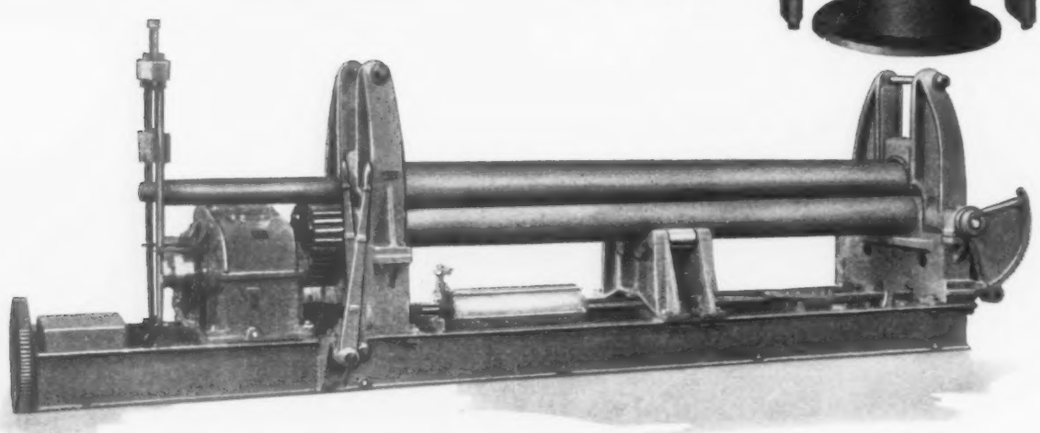
PLATE BENDING ROLLS
PUNCHES AND SHEARS
HYDRAULIC PRESSES
ACCUMULATORS
VALVES
HOT PLATES
Steam and Electric



400 Ton Casting Straightening Press



Plastic Molding Press



Pyramid Plate Bending Roll

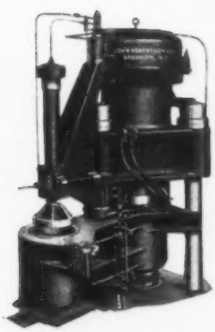
ROCK RIVER ENGINEERING CO.

Chicago Office
549 West Washington Street
Phone Franklin 8940

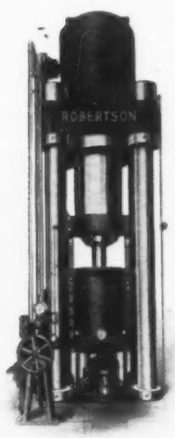
JANESVILLE, WIS.

304 N. Main Street

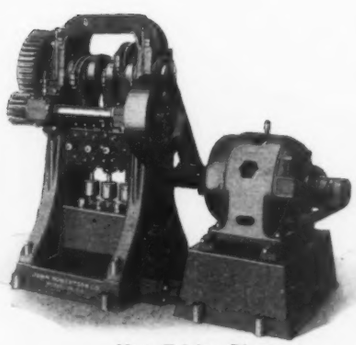
HYDRAULIC PRESSES AND PUMPS EXTRUSION PRESSES FOR LEAD PIPE AND LEAD COVERED ELECTRIC CABLES



Celluloid Filter Press



Lead Cable Encasing Press



New Triplex Plunger Hydraulic Pressure Pump

Built by Pioneers in the Industry

This company has specialized in the manufacture of soft metal extrusion machinery for over 70 years. Robertson Lead Extrusion Presses are in general use in North and South America, and in many parts of Europe, Great Britain, and Japan. As designers and builders of hydraulic equipment for special requirements, we have complete designs and patterns of hydraulic presses available in capacities of 50 to 3000 tons. Our line is special, comprising such equipment as:

EXTRUSION PRESSES
for Lead Pipe, Lead Traps, Solder and Lead Wire, Non-ferrous Alloys, Graphite, Celluloid and other plastic materials, Electric Carbons, and Carbon Electrodes.

LEAD ENCASING PRESSES
for Electrical Cables and Rubber Hose.

PLATEN PRESSES
for Bakelite, Briquettes, Celluloid, Plastic Compounds, Rubber Vulcanizing, Caking, Embossing, Forming, Jewelers, and Silversmiths.

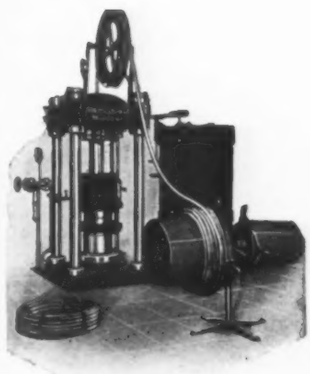
MOULDING PRESSES
for Bakelite, Briquettes, Carbon Electrodes, Celluloid, Plastic Compounds, and Rubber Vulcanizing.

FORGING PRESSES, COMPRESSION TEST PRESSES and FILTERING PRESSES
for Gums, Plastic Compounds.

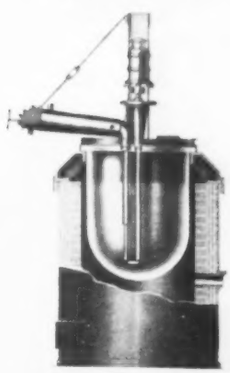
SHEET LEAD ROLLING MILLS

ALSO HYDRAULIC PRESSURE PUMPS

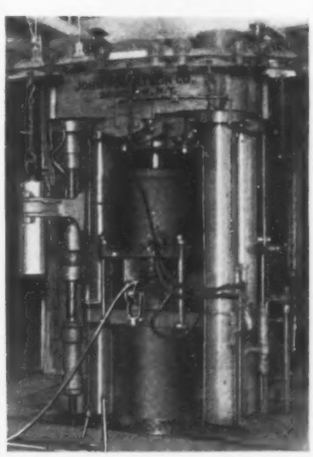
Complete details of any type of equipment supplied on request



650 Ton Lead Pipe Extrusion Press



New Lead Melting Pot and Furnace



Robertson Lead Encasing Press at The Manhattan Rubber Mfg. Co.

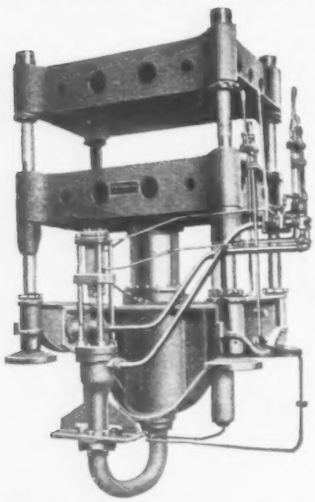
John Robertson Co. 123 Water St. Brooklyn, N. Y.

WOOD Hydraulic Machinery

WE DESIGN AND MANUFACTURE:

Accumulators, Intensifiers, Presses for Baling, Bending, Bushing, Forcing, Forging, Drawing, Dishing, Forming, Flanging, Joggling, Moulding, Piercing, Straightening, Vulcanizing, Scarfing, Stamping, Upsetting, etc. Wheel Presses, Lead Presses, Linoleum Presses, Bakelite Presses, Extrusion Presses, Spring Banding, Stripping and Assembling Presses. Fixed and portable Riveters, Plate and Bar Shears, Valves and Fittings; special hydraulic machinery for every purpose.

HYDRAULIC PRESSES:

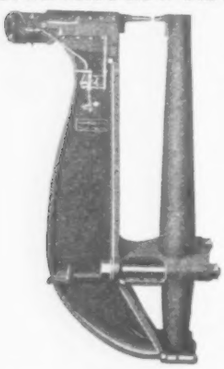


Up or down working and with or without slack water filling system.

Built in any size and in capacities up to 10,000 tons.

Designed for the most severe operating conditions and continuous service, the valve arrangement permitting the highest practical speeds of the press rams.

HYDRAULIC RIVETERS:



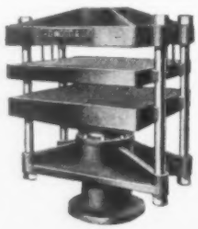
Of all sizes and capacities, and of the stationary or portable type.

Forged steel stake riveters for riveting water tube boiler drums.

Special riveters with chrome nickel steel horn to permit riveting of boiler heads to shells through manholes.

Hinged type riveters for car and girder work.

HYDRAULIC STEAM PLATEN PRESSES:

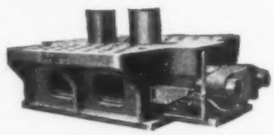


Built in all sizes and capacities with single or multiple openings, and with cast iron or rolled steel plate steam platens.

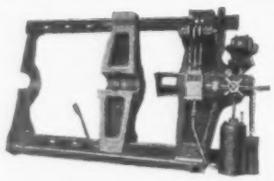
Rigid in construction and designed for heavy service.

HYDRAULIC BENDING PRESSES:

For bending structural shapes and heavier pipe. Built in various sizes and capacities.



HYDRAULIC WHEEL PRESSES:



From 100 to 1000 tons capacity. Designed for rapid speeds.

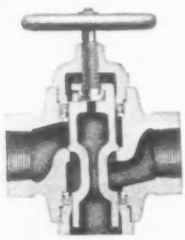
The resistance post may be designed to accommodate booster gears.

HYDRAULIC BULLDOZERS:

Built in various sizes and capacities and of the single or multiple power type.



HYDRAULIC VALVES:



Of all sizes and for pressures up to 10,000 pounds per sq. inch.

Operating valves, stop and check valves, shock valves, safety-relief valves, two-pressure valves.

R. D. WOOD & COMPANY

Established 1803

400 Chestnut St., PHILADELPHIA, PA.

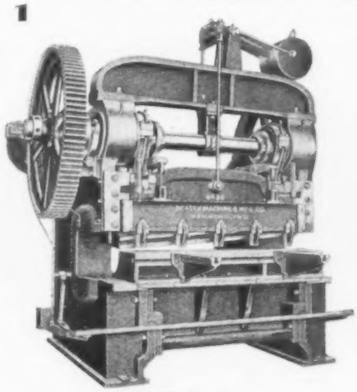
Engineers, Iron Founders, Machinists

Cable Address: "TUCKAHOE", PHILADELPHIA

FOUNDRIES AND WORKS: FLORENCE, N. J.

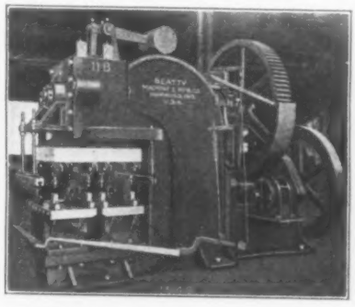
Beatty PUNCHES-SHEARS

1



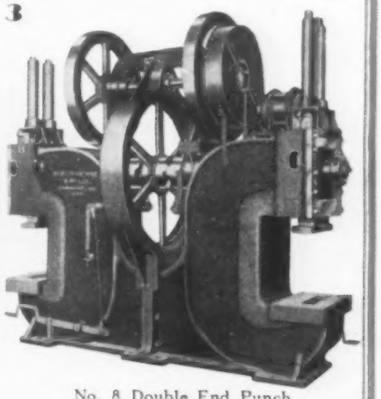
No. 30 Plate Shear

2



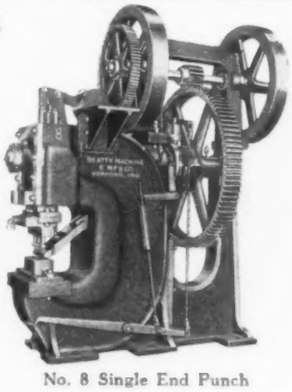
No. 11 Beam Punch

3



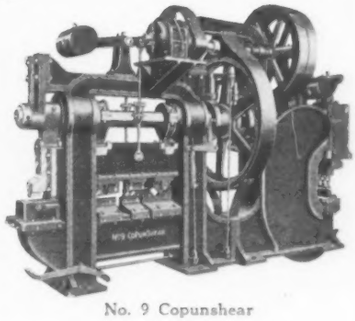
No. 8 Double End Punch

4



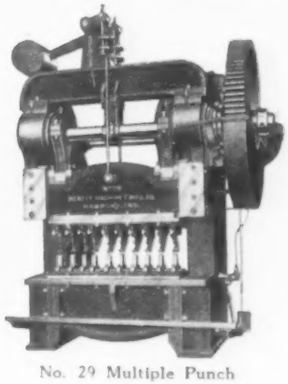
No. 8 Single End Punch

5



No. 9 Copunshear

6



No. 29 Multiple Punch

1 "BEATTY" PLATE SHEARS:
These shears are of massive construction built for heavy duty work and come in sizes from 36″ x ¼″ plate to 144″ x 1″ plate.

2 SPECIAL HEAVY DUTY PUNCHES:
These machines are built in several sizes with extra large die space for production work and are employed extensively on production work in railroad shops and steel car manufacturing plants.

3 "BEATTY" DOUBLE END PUNCHES:
These punches are built with a combination of throat depth and tooling space and a wide range of capacities.

4 "BEATTY" SINGLE END PUNCHES:
Built in a large variety of sizes with capacities ranging from ½″ hole through ½″ plate to 6″ hole through 2″ plate. Throat depth: 10″ to 72″. Tooling or die spaces in standard patterns are of liberal sizes. Can be enlarged to special requirements.

5 "BEATTY" COPUNSHEAR:
The "Beatty" Copunshear is a combination punch, shear and coping machine built in several sizes. The range of work for which they are adapted includes practically every kind of bar and angle cutting, punching and coping.

6 "BEATTY" MULTIPLE PUNCHES:
These machines are built in a wide variety of sizes. The rated capacities run from 30 to 1500 tons, and lengths up to 16 feet. Also special designs for large production work.

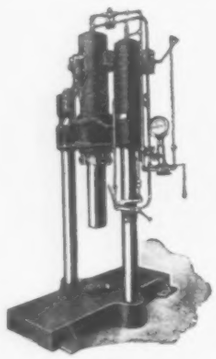
ENGINEERING SERVICE:
We are prepared to design special automatic feed and special types of punches and shears, plate or bar type, to suit your own specifications. Catalog sent promptly upon request.

BEATTY MACHINE & MANUFACTURING CO.

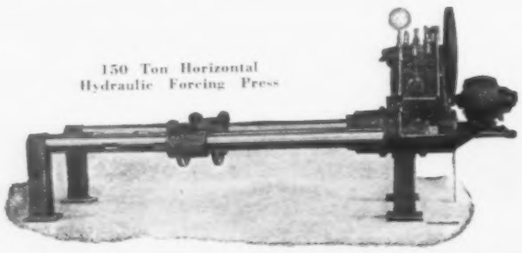
General Office and Works

150th and Oak Streets, HAMMOND, INDIANA

Manufacturers of Plate and Sheet Metal Working Machinery and Portable Floor Cranes



Hydro-Pneumatic Forcing & Bushing Press



150 Ton Horizontal Hydraulic Forcing Press



Weighted Accumulator

HYDRAULIC MACHINERY

If you are considering buying hydraulic machinery of any kind or for any purpose, remember Watson-Stillman Hydraulic Machines have a reputation for quality. They are built by hydraulic specialists, who have devoted their entire business existence to the design and construction of hydraulic machinery.

We show here a few examples of our large line.

We build complete hydraulic plants including pipe, valves, pumps, accumulators, intensifiers, and presses for every purpose such as

Bending	Baling
Forcing	Lead Covering
Forming	Sagger Moulding and Clay Forming
Dehydrating	Moulding and Vulcanizing
Thermo Plastic Moulding	Oil Extracting
Blocking and Extruding	Compressing, Etc.

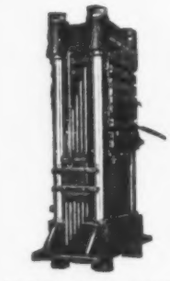
Our machines are giving daily satisfaction in some of the largest plants in this country.

If your needs are special we will be glad to quote on new design or adapt one of our standards to suit. In either case, it will pay you to consult us before buying elsewhere.

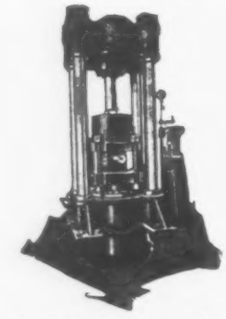
Write for Bulletins

THE WATSON-STILLMAN CO.
71 WEST ST., NEW YORK

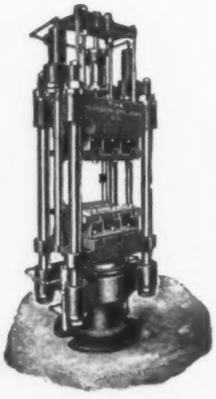
Widener Building, Philadelphia; 2501 W. Third St., Cleveland; 228 N. LaSalle St., Chicago; 2970 W. Grand Blvd., Detroit; 705 Olive St., St. Louis; Union Trust Bldg., Pittsburgh; 1039 Mutual Bldg., Richmond



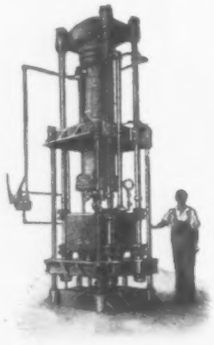
Multiple Plate Heating Press



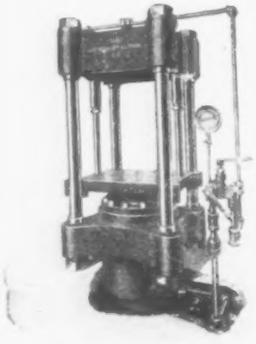
Lead Press for covering electric cable with lead and for the manufacture of rubber hose



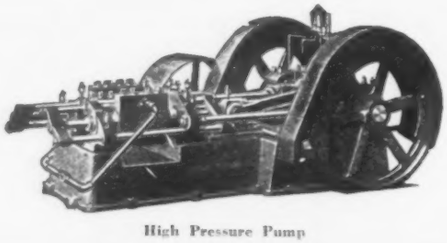
Plastic Moulding Press for moulding thermos plastic materials



Hydraulic Press for Sagger Moulding



Hydraulic Die Press



High Pressure Pump



1000 Ton Die Hydraulic Press

POWER

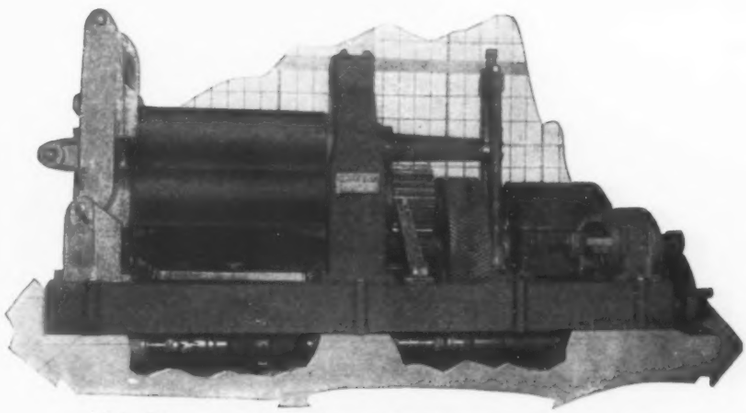
Proof of Ability to Build Dependable Machinery

FOR more than fifty years we have built special machinery for the foremost industries in this country. That this machinery has been dependable and efficient is demonstrated by our ever increasing number of satisfied customers. Here we illustrate for you a few of the recent machines we have built, offering visual evidence of our ability to build dependable machinery for you, NOW.

Your inquiries solicited

WE DESIGN AND BUILD

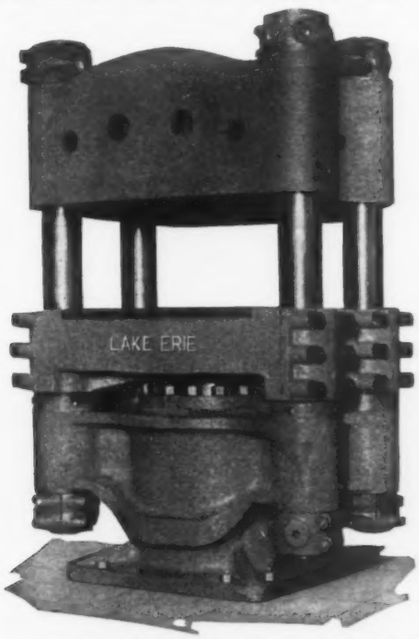
- Hydraulic Presses and Accumulators
- Valves and Fittings
- Plate Working Machinery
- Special Machinery
- Punches and Shears
- Bending Rolls
- Plate Planers
- Rolled Steel Steam Plates
- Railroad Scale Test Cars
- Sugar Machinery



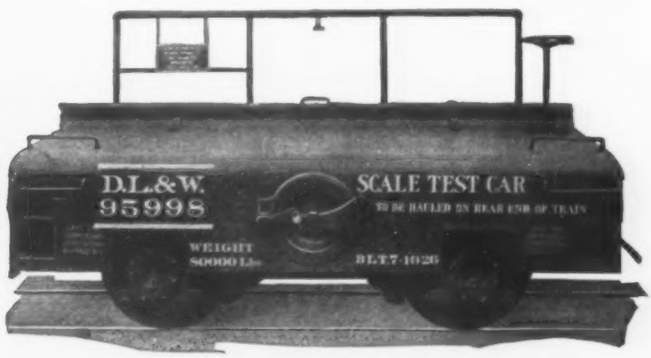
A Lake Erie Plate Bending Roll built for General Electric to roll 48 inch motor frames of 3 inch plate. Note the excellent method by which the housing end is dropped to permit the expeditious removing of completed cylinders.



Here are eight of an order of twenty steam Platen Presses made for a large manufacturer of rubber heels. These presses have rolled steel steam plates and were furnished complete with elevators. An infinite variety of rubber, vulcanized and plastic goods is made on Lake Erie presses.



A 940 ton Hydraulic Press, designed for pressing abrasive grinding wheel products. A Lake Erie Hydraulic Press can be built in any tonnage necessary to meet your requirements.

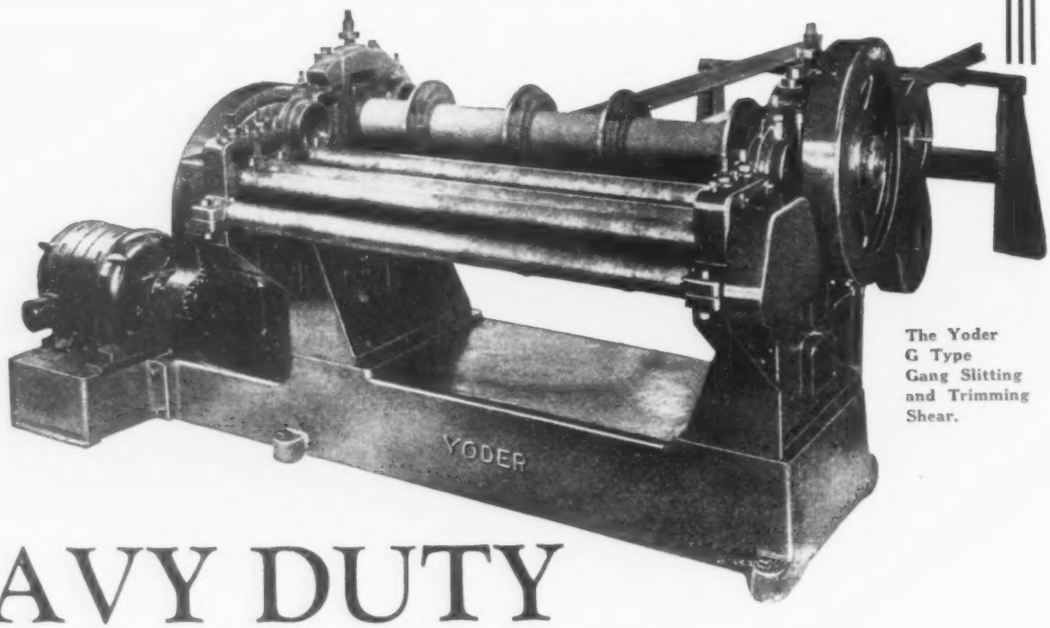


One of the many 80,000 lb. Scale Test Cars we have built. This car is built in accordance with A. R. A. standards, and has a special spotting device which is a great saver of time and expense.

LAKE ERIE ENGINEERING CORPORATION

BUFFALO 270 PERRY ST. NEW YORK

LEE CORP.



The Yoder G Type Gang Slitting and Trimming Shear.

HEAVY DUTY

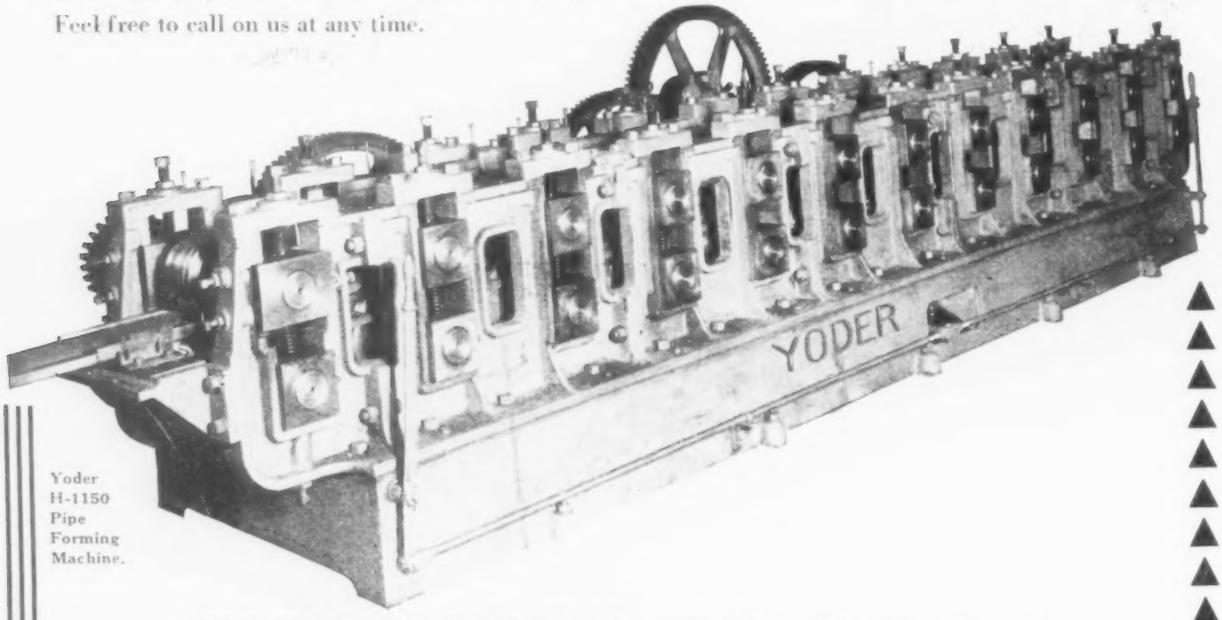
Plate and Sheet Metal Working Equipment

The Yoder Line of Plate and Sheet Metal Working Equipment is large. We build rolling machines for forming Standard Iron Pipe in sizes from 3.8″ O. D. UP TO AND INCLUDING 24″ O. D. x ¾″ WALL.

Our engineers are specialists in every branch of plate and sheet metal working machinery. Their opinions and advice will cost you nothing—but may be the means of helping you materially.

Feel free to call on us at any time.

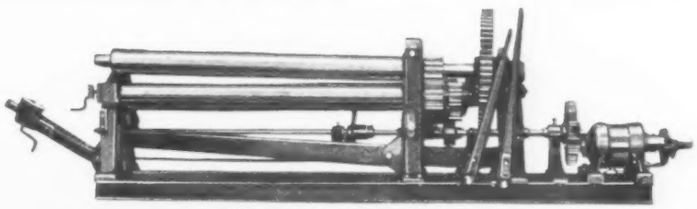
We build a complete line of Plate and Sheet Metal Working Machines—Gang Slitting Shears — Rotary Shears — Automobile Sheet Metal Forming Machines — Pipe Forming Machines.



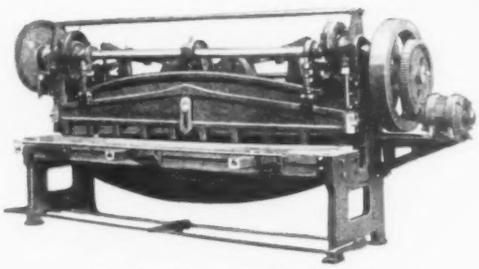
Yoder H-1150 Pipe Forming Machine.

THE YODER COMPANY

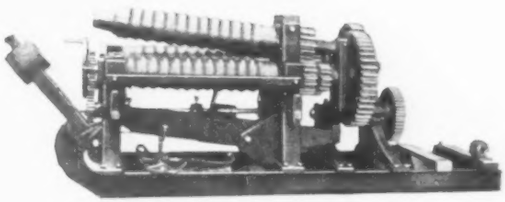
Walworth Ave. at W. 58th St., Cleveland, Ohio



Initial Pinch Type Plate Bending Roll. Capacity 10′ x ¼″.

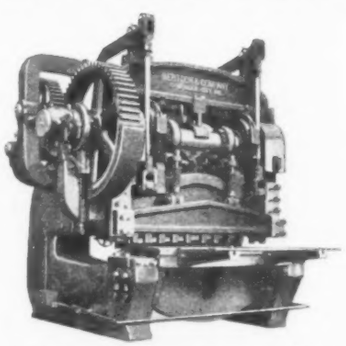


Squaring Shear. Capacity 10′ x 10 ga.—shallow gap.

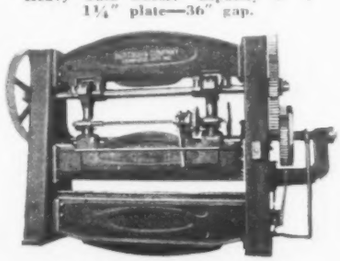


Corrugated Culvert Roll.

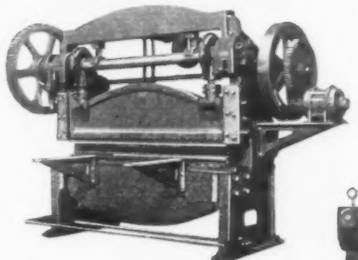
SHEARS, PUNCHES, ROLLS, BENDING PRESSES



Heavy Gate Shear. Capacity 6′ x 1¼″ plate—36″ gap.



Power Press Brake. Capacity 10′ x 10 ga.



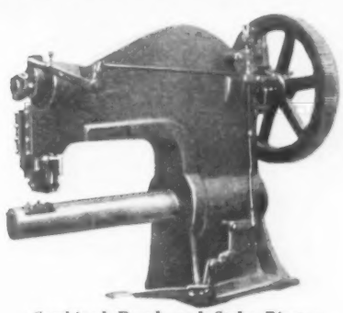
Multiple Punch. Capacity—½″ holes in ¼″ plate.

Capacities from the Lightest Sheet Metal to the Heaviest Plate

We build complete lines of light and heavy machinery. Suitable for all classes of sheet metal, plate and structural work.

BERTSCH & CO.

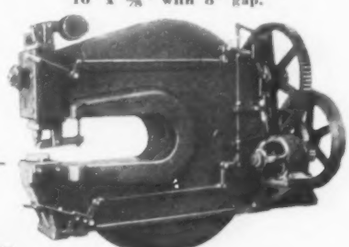
Cambridge City, Ind.



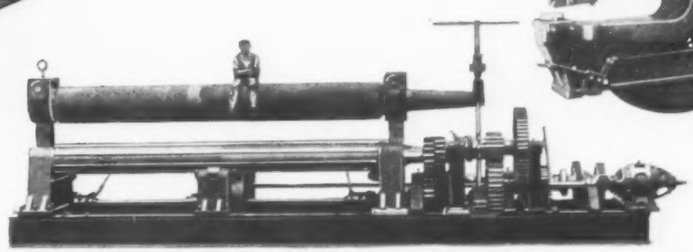
Combined Punch and Stake Riveter for corrugated culvert work.



Power Press Brake. Capacity 10′ x ⅜″ with 8″ gap.



Single End Punch and Shear.



Pyramid Plate Bending Roll. Capacity 18′ x 1¼″.

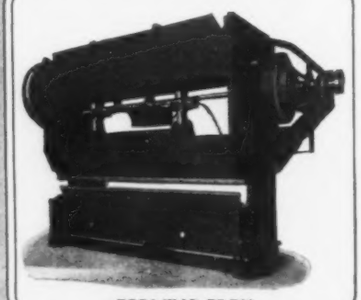
CHICAGO
STEEL BENDING BRAKES AND FORMING PRESSES

The perfected result of over 30 years experience in the manufacture of sheet metal bending machines. Over 25,000 machines in use.



POWER BRAKE

Hand Brakes
Cornice Brakes
Power Brakes
Box and Pan Brakes
Forming Presses
Special Brakes and Presses

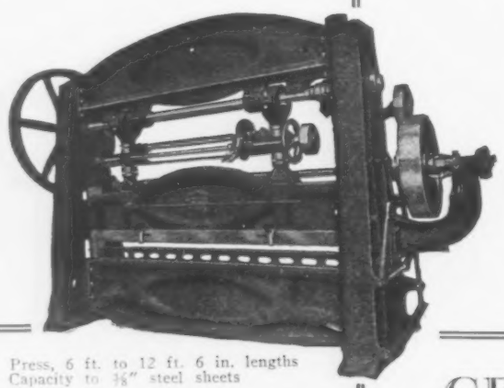


FORMING PRESS

The most complete and up-to-date line of sheet and plate bending and forming machines in the world. Lengths, 3 to 16 feet, with capacity to bend from the lightest metals up to ¾ in. plate, cold.

DREIS & KRUMP MANUFACTURING CO.
Loomis Street · Chicago

HERE'S— *What you can do on this OHL-10 Ft. Power Brake*



Press, 6 ft. to 12 ft. 6 in. lengths
Capacity to ⅜" steel sheets

—Bend a ten-foot sheet of No. 10 gauge steel—or, form skylight bars of No. 26 gauge steel in two operations. The seven members are bent in one operation and the bar squeezed together in the next.

This OHL Power Brake is equipped with a new method of holding dies, is amply proportioned, and heavily constructed, and includes a patented friction gear.

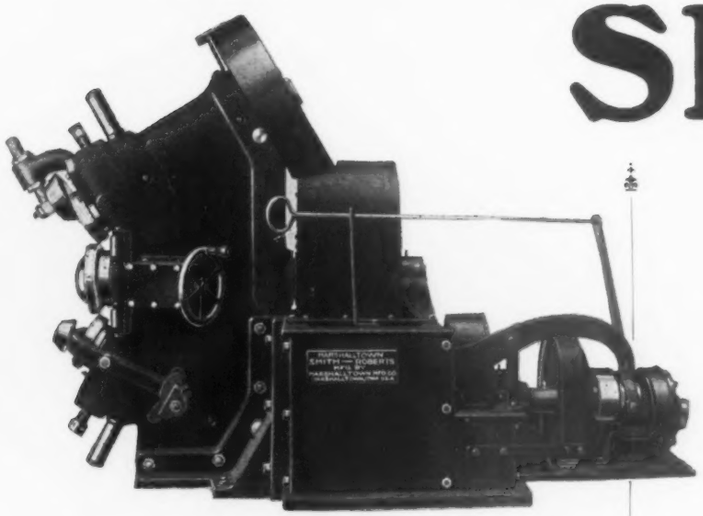
We'll be glad to go over this machine with you point for point and explain how economical—and simple—it is to operate.

GEORGE A. OHL & CO., Inc.
Originators of Sheet Metal Working Machinery Since 1863
151-161 Oraton St. **Newark, N. J.**

Crimping and Hammering Machines — Slitting Shears—Power Presses.

Double Cam Brakes—Slip Roll Formers—Squaring Shears—Mitre Cutters—

Marshalltown Shears



No. 234 Double Rotary Bevel Shear

A ROTARY BEVEL SHEAR designed to combine the Standard Bevel Shear with the Inverted Bevel Shear, making it possible to bevel from both sides of a sheet without turning the same before passing through the rolls.

SPECIFICATIONS

CAPACITY—For beveling ¾" and lighter.

SIZE OF CUTTERS—Upper and lower 9"x2", the center 11"x 2", are made of high grade special tool steel.

DEPTH OF THROAT—4".

SPEED—285 R.P.M., cuts 8' per minute.

MATERIAL USED IN CONSTRUCTION—

Head—Gray Iron Casting
Base—Gray Iron Casting
Gears—Steel and Cast Iron

DRIVE—A friction clutch pulley is furnished with Belt Drive Shears and a friction clutch gear is furnished with Motor Drive, which enables the operator to Stop the Shear and allow the motor to remain running.

THE STANDARD SHEAR—Is equipped for Motor Drive. If a Belt Drive is desired, it can be furnished. There will be an additional charge made for a reversible counter shaft which is required.

MOTOR REQUIRED—7½ H.P., 1200 R.P.M.

FLOOR SPACE REQUIRED—4'6"x7'4".

DISTANCE FROM FLOOR—To cutting edge of upper cutter 35"; to cutting edge of lower cutter 25".

THE MARSHALLTOWN LINE

Throatless and Bevel Shears
Splitting Shears
Plate Bending Rolls
Pressure Gauges of all Kinds

Reduce Labor Costs

No. 112 Throatless Shear

The THROATLESS SHEARS are labor savers. They will reduce cutting costs. They cut all kinds of shapes from sheets of any size.

SPECIFICATIONS

CAPACITY—½" and lighter. Cuts to 10" radius.

CUTTERS—Size 10"x1⅞". Made of high grade special tool steel. One cutter knurled to feed material.

ADJUSTMENT—Made easily. Full instructions furnished with each Shear.

SPEED—270 R.P.M., Cuts 6' per minute.

MATERIAL USED IN CONSTRUCTION—

Head—Steel Casting
Base—Gray Iron Casting
Gears—Steel and Cast Iron

STYLE AND POWER—	CODE WORD
No. 112-P Belt Power	*Gambit*
No. 112-M Motor Drive	*Gammon*

DRIVE—A friction clutch pulley is furnished with Belt Drive Shears and a friction clutch gear is furnished with Motor Drive which enables the Operator to stop the Shear and allow the motor to remain running. Size of Pulley—16"x6".

MOTOR REQUIRED—5 H.P., 1750 R.P.M.

FLOOR SPACE REQUIRED—2'8"x4'2".

DISTANCE FROM FLOOR TO CUTTERS—42".

SHIPPING INFORMATION

No. 112-P BELT POWER—Net weight 4600 lbs., crated 4900 lbs. Completely boxed 5000 lbs. Dimensions when boxed 3'6"x6'x6'2".

No. 112-M MOTOR DRIVE—Net weight 4800 lbs., crated 5200 lbs. Completely boxed, 5700 lbs. Dimensions when boxed, 3'6"x6'x6'2".



No. 112 Throatless Shear

Marshalltown Manufacturing Co.

Marshalltown, Iowa, U. S. A.

SMITH PUNCHES—SHEARS BENDING MACHINES

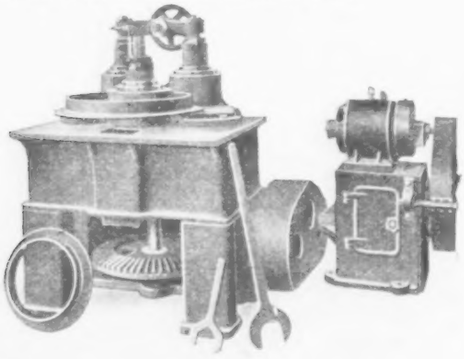
Will Put Your Shop on a Bigger Profits Basis

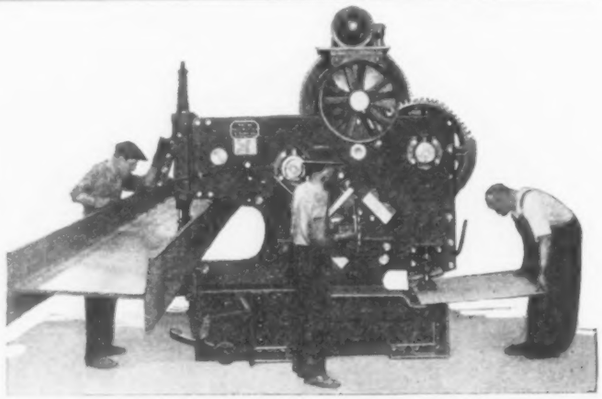
A shop is only as profitable as its equipment is efficient. You can't hope to get along with out-moded machinery and still be on a competitive basis. Right now there's a big swing to Smith machines because in every installation they have proven fast in operation, thoroughly dependable, and outstandingly economical. Only two Smith models are illustrated here. There are, however, many others—one for every shop requirement.

Famous for Accuracy SMITH BENDING MACHINES

For Rolling Angles, Tees, Beams, Channels, Flats, Rounds and Squares in Circles or Arcs—Cold.

THESE machines are designed with an adjustable roll which makes change of rolls unnecessary when you switch from one section to another. . . But what's even more important is that every arc or circle comes out absolutely true and accurate, thus eliminating costly straightening charges. Equipped with a reversible clutch, this machine is capable of a maximum output at a minimum cost.





SMITH *Triple and Quadruple Combination* PUNCHES and SHEARS

UNBREAKABLE STEEL PLATE FRAME

LET the flange sections come through as big as they want to make them—this Smith machine has a high wide throat that handles them easily. And the shear end is just as efficient . . . angles and tees can be cut on the inside or outside . . . left or right hand mitre from the front of the machine without changing the knives. The thousands of Smith machines already in satisfactory use in shops all over the country testify to their excellence.

The longest bars and the largest rings can be handled easily on Smith Bending Machines.

Send for Descriptive Literature about Smith Machines

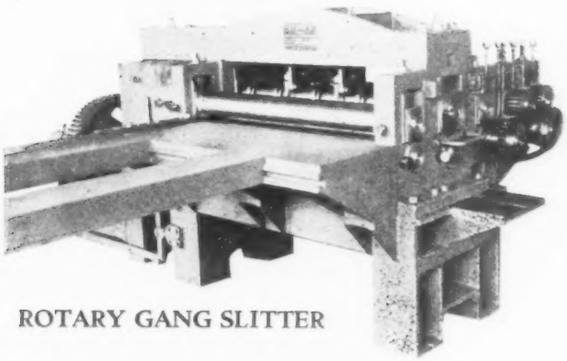
There is a Smith Machine suitable for every purpose. Let us send you descriptive literature and prices.

Notches and Copes; Punches, Wide Flange Sections; Shears and Mitres, Angles and Tees; Shears, Rounds, Squares, Beams and Channels.

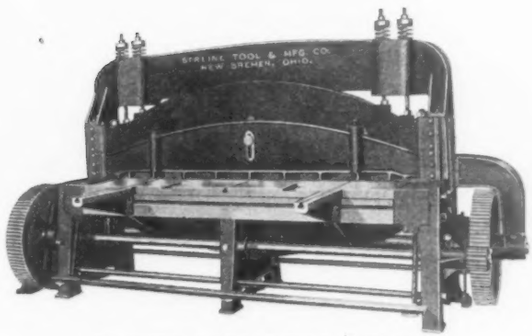
David H. Smith & Sons, Inc.... Brooklyn, N.Y.

Distributors in All Principal Cities of U. S. A. and Canada.

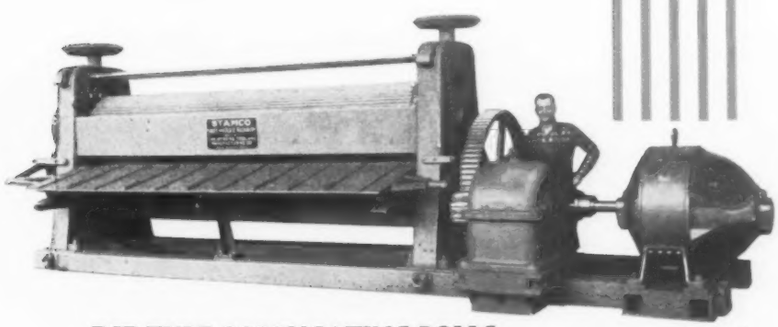
SHEET AND PLATE MACHINERY



ROTARY GANG SLITTER



POWER SQUARING SHEAR



DIE TYPE CORRUGATING ROLLS

CONTINUOUS — AUTOMATIC

MILL SHEARING EQUIPMENT

For use in:

Sheet Steel Mills
Jobbing Mills
Steel Plate Mills
Tin Plate Mills
Nonferrous Sheet and Plate Mills

◆ ◆

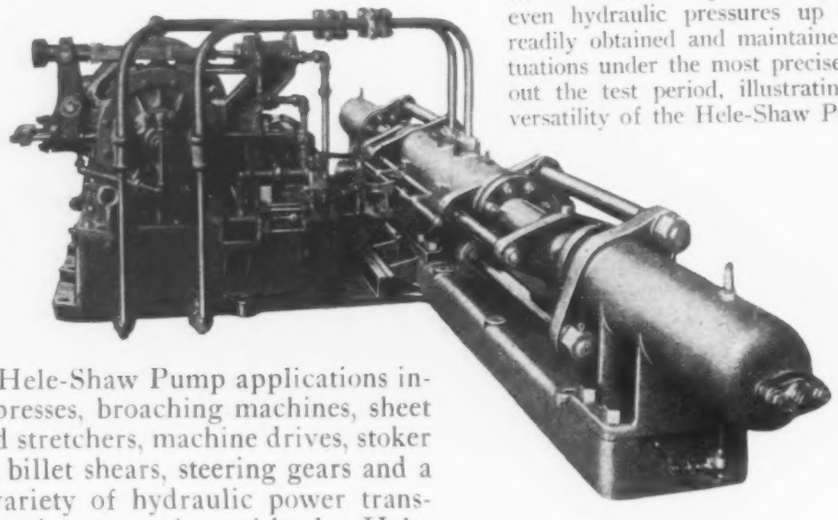
We are also builders of

Power Squaring Shears
Hot Mill Shears
Tin Mill Shears
Rotary Gang Slitters
Corrugating Rolls
Crimping Rolls
Toggle Type Forming Presses
Curving and Culvert Rolls
Conductor Pipe Machinery
Roll Roofing Machinery
ETC.

THE STREINE TOOL & MANUFACTURING CO.

NEW BREMEN, OHIO, U. S. A.

For Exact Pressures . . . . The Hele-Shaw



In the Lassman System of pipe-testing steady, even hydraulic pressures up to 2500 lbs. are readily obtained and maintained free from fluctuations under the most precise control throughout the test period, illustrating once more the versatility of the Hele-Shaw Pump.

Write for Hele-Shaw Catalogue

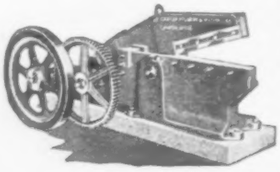
Other Hele-Shaw Pump applications include presses, broaching machines, sheet and rod stretchers, machine drives, stoker drives, billet shears, steering gears and a wide variety of hydraulic power transmissions in connection with the Hele-Shaw Hydraulic Motor.

AMERICAN FLUID MOTORS COMPANY

2410 Aramingo Avenue Philadelphia, Pa.

Canton Alligator Shear

Solid Steel Throughout



If you cut bars, sheets, or scrap, you can save money both in power and operating costs by installing a Canton All Steel Alligator Shear.

Its solid steel construction assures you of many years of profitable service.

Write for catalog and prices

Canton Foundry & Machine Co.

Canton Ohio

New York Office 101 W. 31st St., Greeley Square Bldg.

No. 8 Roller Bearing Punch



Capacity ¼" thru ¼", Weight, 16 lbs. Made in 3 Sizes, Nos. 7, 7½ and 8.

No. 10 Ball Bearing Punch



Capacity, ⅜" hole through ¼" iron.
Weight, 8½ lbs.

Write for Catalog and Price List on Entire Line.

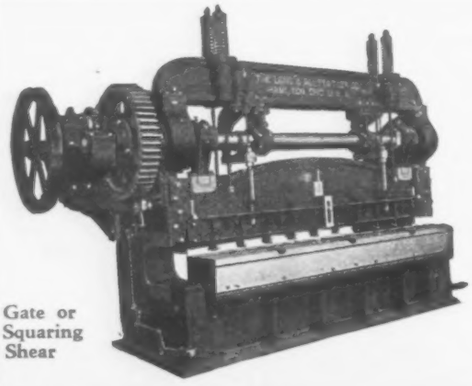
No. 6 Roller Bearing Slitting Shear



Capacity—
Throatless — Will cut all thicknesses up to and including 3/16 inch.

WHITNEY METAL TOOL CO.

100 FORBES STREET, ROCKFORD, ILLINOIS



Gate or Squaring Shear

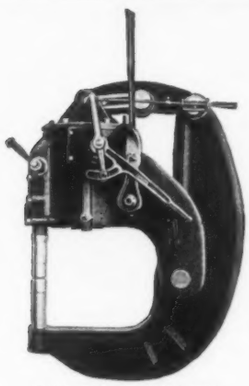
Power Punching and Shearing Machinery

Coping and Bending Machines

Spacing Tables

THE LONG & ALLSTATTER CO.
HAMILTON, OHIO

HANNA RIVETERS
MEET EVERY CONDITION



PINCH BUG RIVETER

Not only the perfection of design and construction of the HANNA RIVETERS recommend them to the manufacturer who has to produce riveted work, but the purchaser of our Riveters is assured of all the benefits derived from our broad and diversified experience and finds us in position to offer suggestions for complete installations so well as Riveters for special work.

Over four thousand HANNA RIVETERS in operation.

A machine to meet every condition. Sizes range from 4 inch to 21 foot reach. Capacities from 6 to 150 tons.



PORTABLE YOKE RIVETER—FORGED NOSE



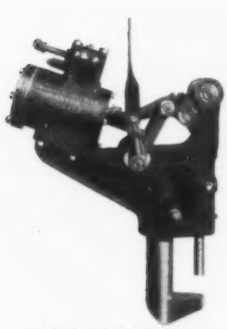
STATIONARY YOKE RIVETER



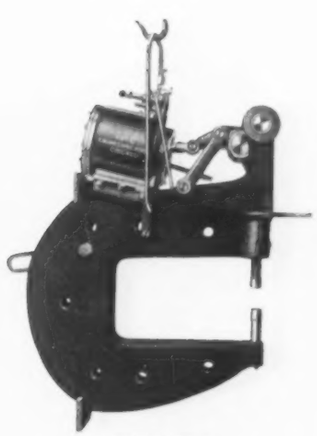
COMPRESSION LEVER RIVETER



DEEP GAP BULL RIVETER WITH FORGED STAKE



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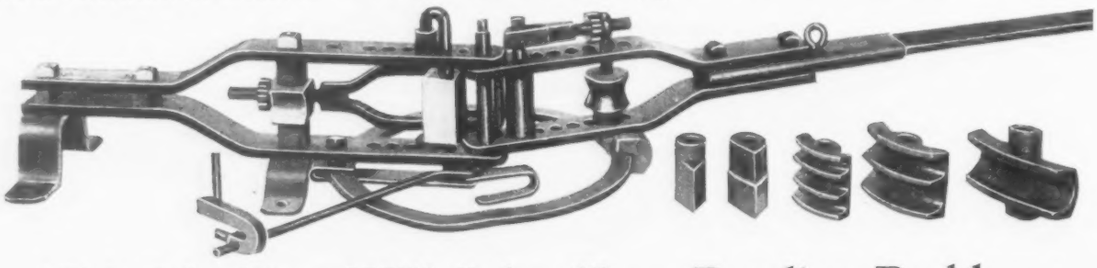


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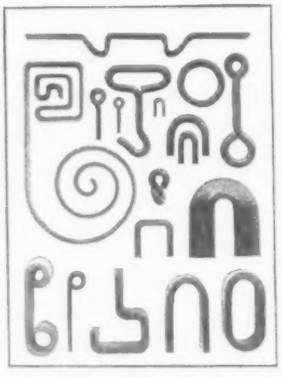
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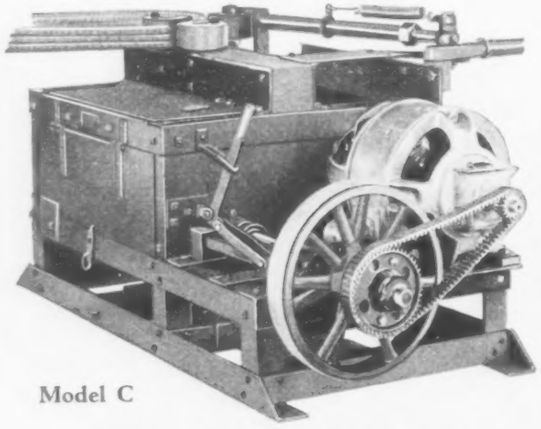
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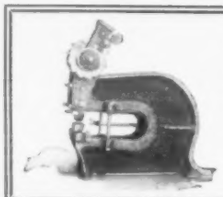
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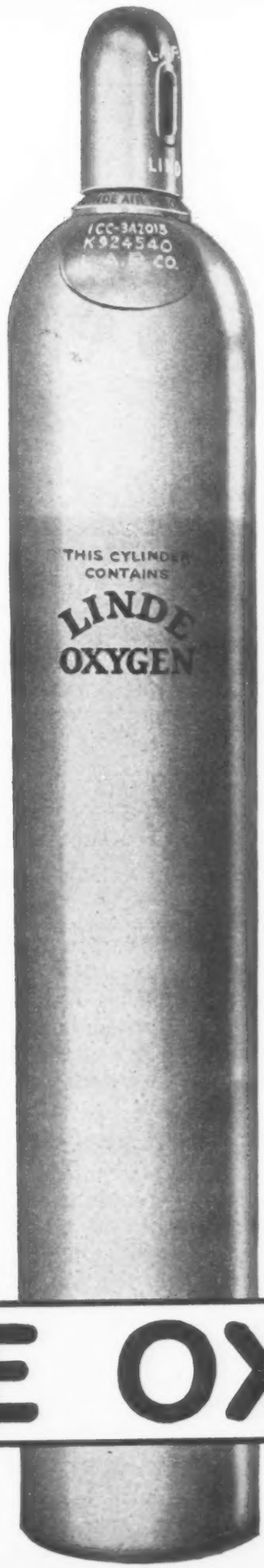
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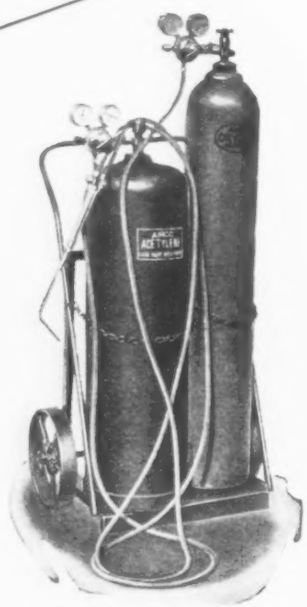
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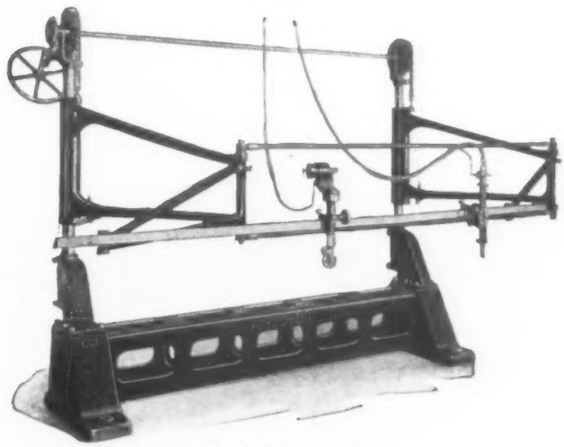
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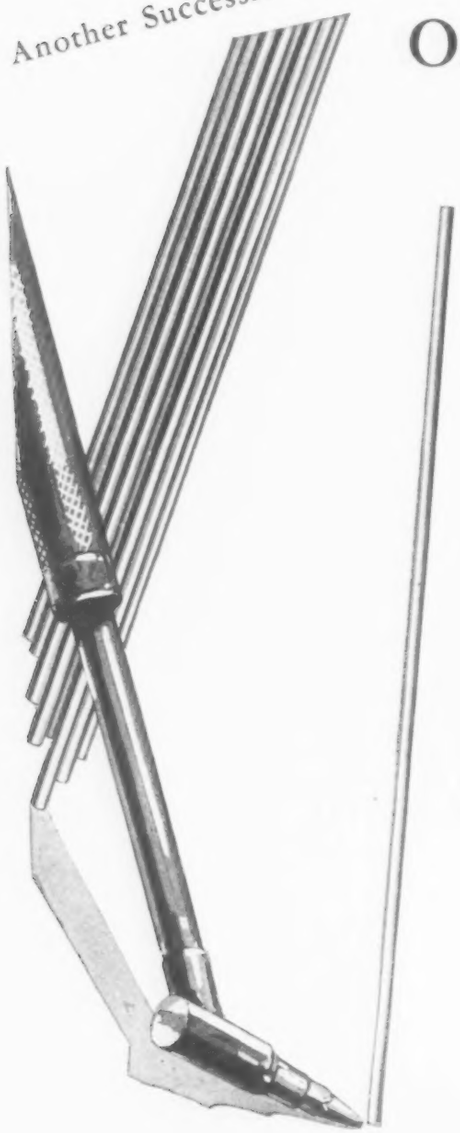
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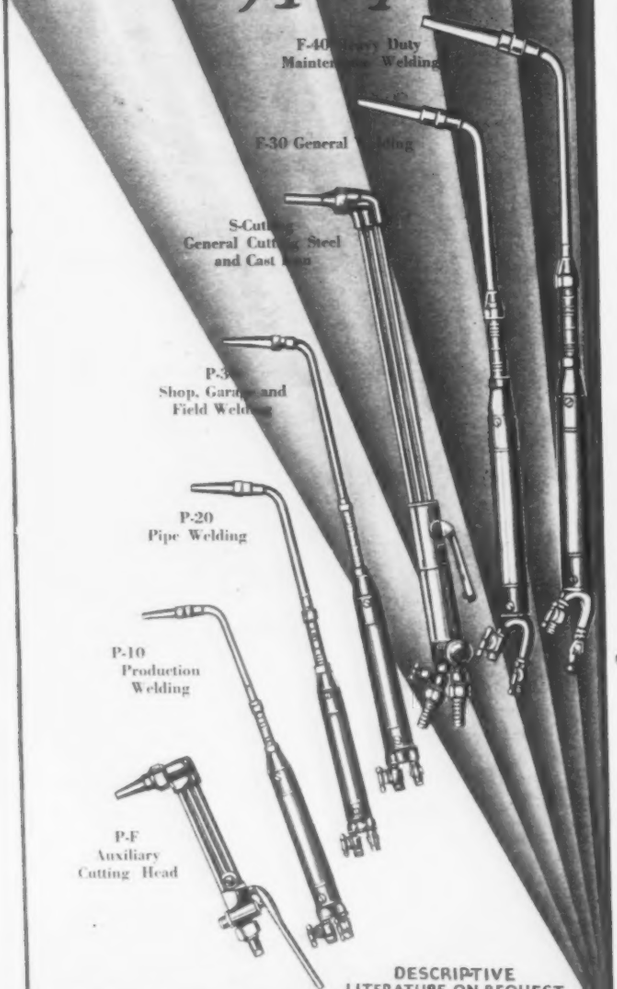
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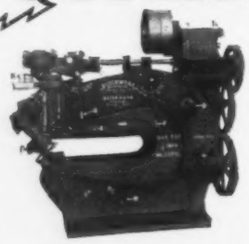
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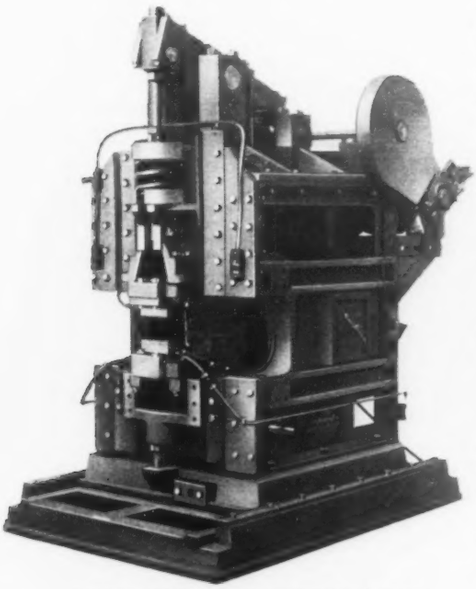
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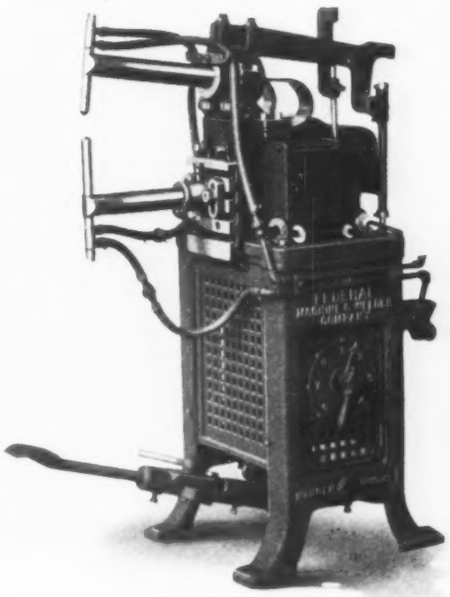
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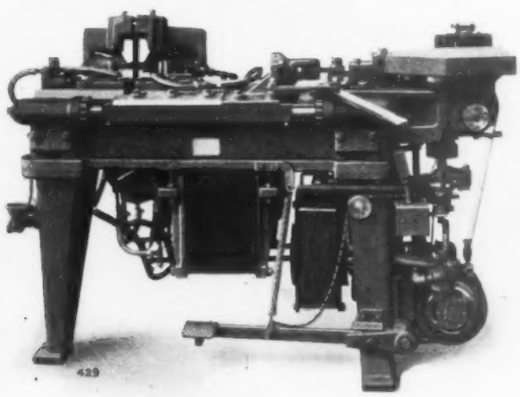
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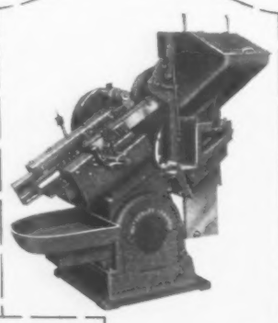
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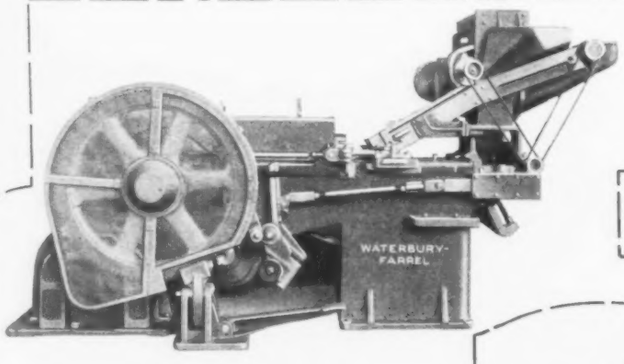
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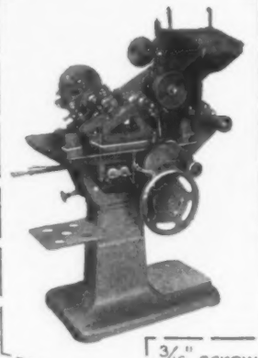


⅜" automatic screw threader. 75 per min.



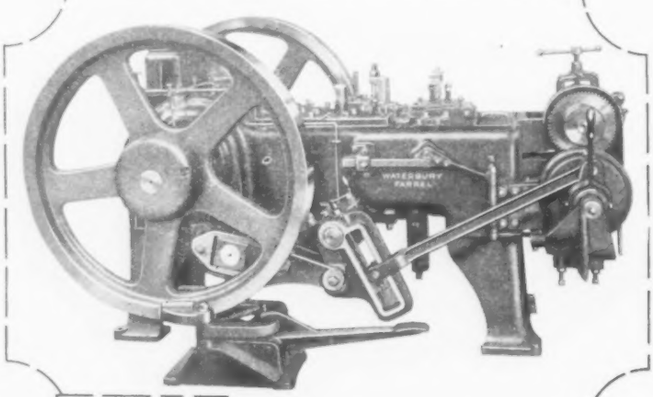
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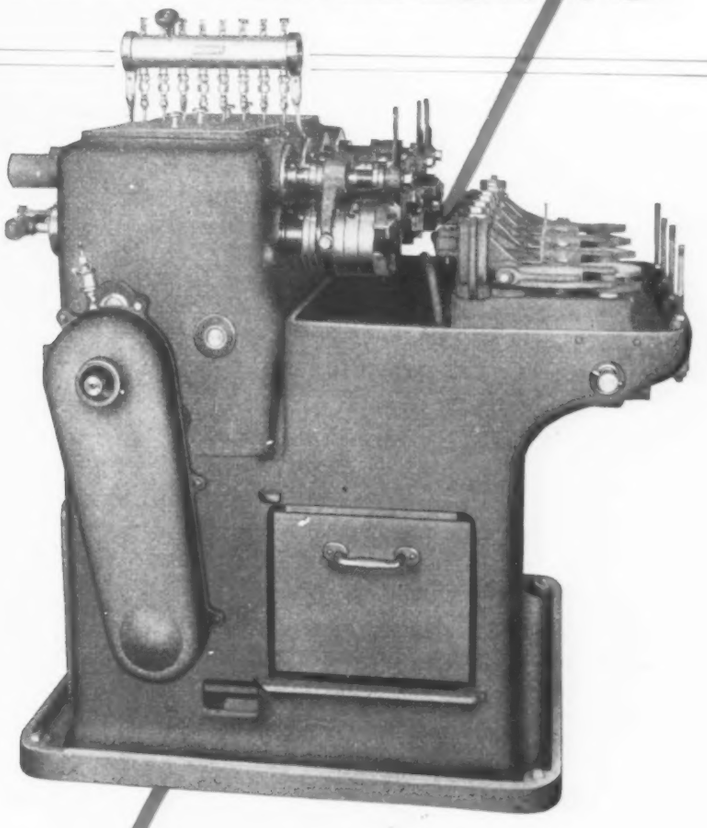
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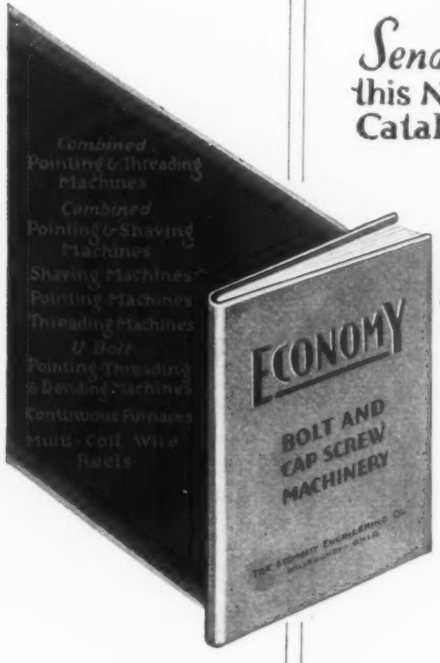
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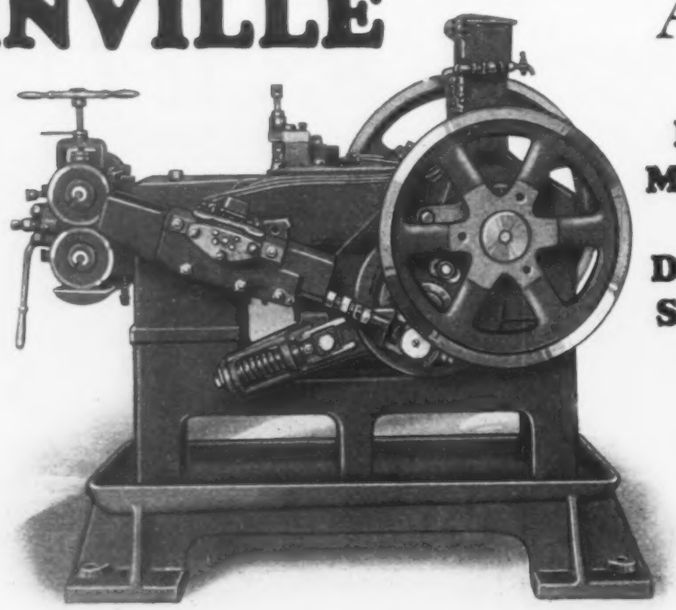
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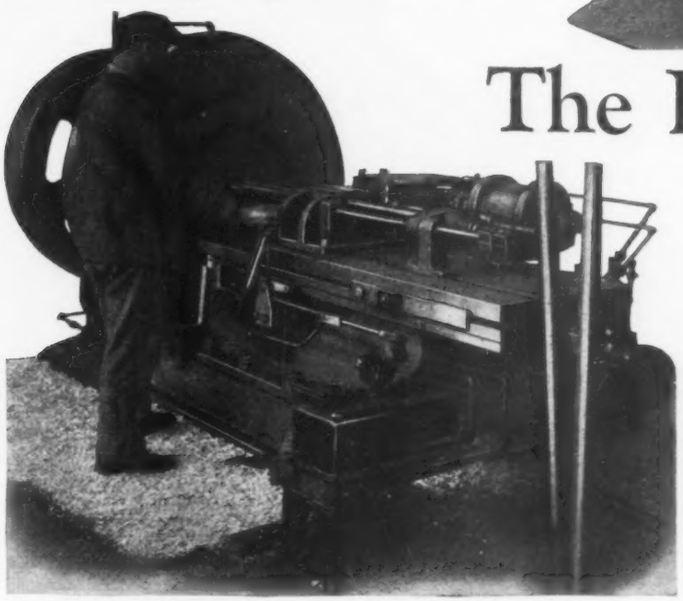
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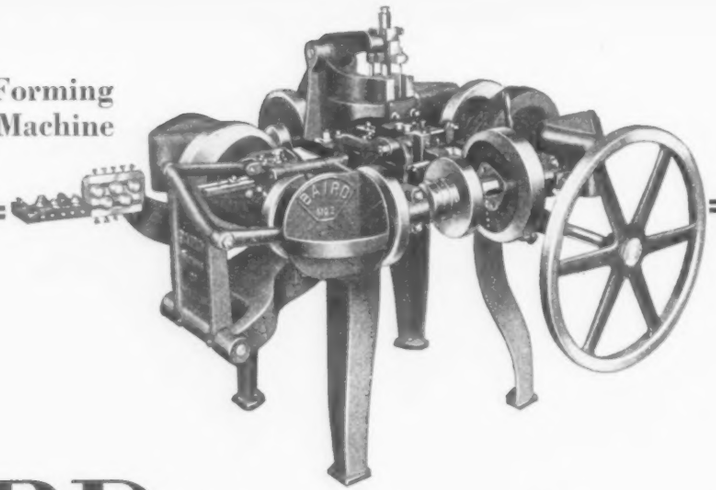
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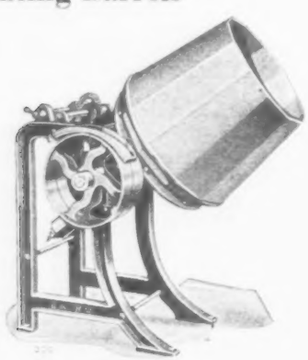
BAIRD Can Save You Money

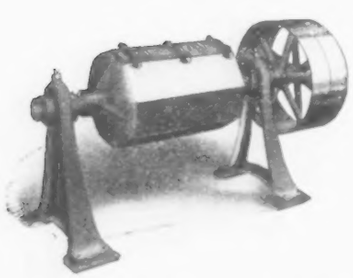
Four Slide Forming Machines for cutting, forming, punching and marking will prove a real money saver to manufacturers of small parts from wire or ribbon metal.

They are built in 11 sizes.

Automatic Presses are designed for maximum production at minimum cost. The BAIRD Automatic Press takes ribbon stock from a coil and feeds, pierces, blanks, transfers, forms and ejects it finished—entirely automatic.

Tumbling Barrels

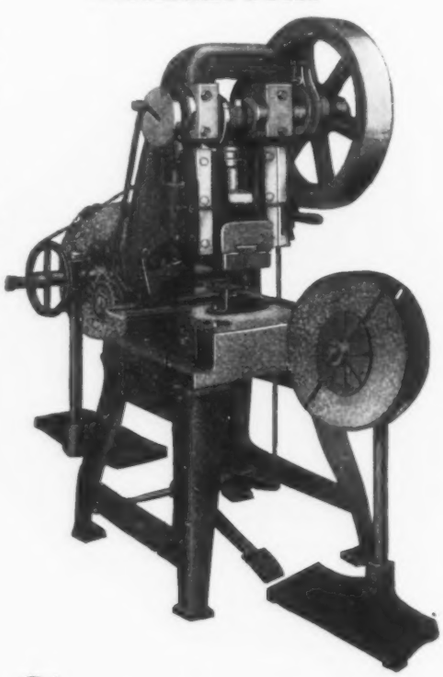




BAIRD Tumbling Barrels will clean, dry, polish, burnish, color or rustproof—they cut down the cost.

They give a smooth, even surface—will break sharp corners and rough surfaces of castings.

Automatic Press



"Ask BAIRD About It"

The Baird Machine Company

BRIDGEPORT, CONN.

Straightener Specialists Since 1866

SHUSTER

STRAIGHTENING AND CUTTING MACHINERY

for

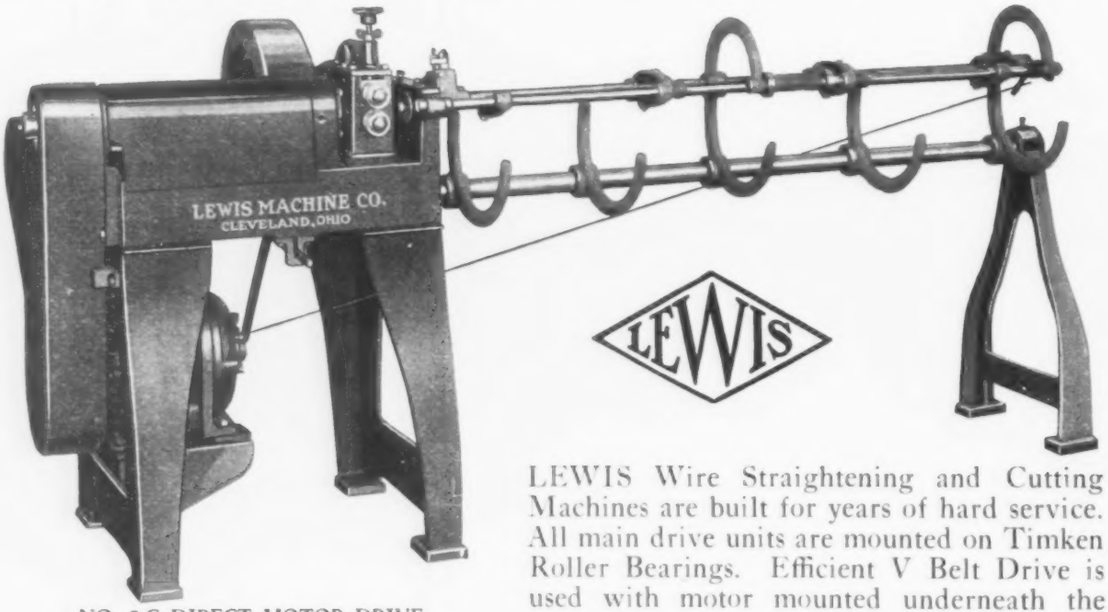
ROUND WIRE, COLD DRAWN STEEL, BRASS, COPPER AND ALL ALLOYS, HOT ROLLED STOCK, SHAPES

WE understand the requirements of the users of Straightening Machinery, and are prepared to meet them from our large line of various types, either with or without automatic cut-off.

We have belt-driven types, direct motor-driven self-contained machines, rotary types, roll types, etc.

THE F. B. SHUSTER COMPANY
NEW HAVEN, CONN.
Established 1866

FOR ECONOMICAL WIRE CUTTING



NO. 2-C DIRECT MOTOR DRIVE
BUILT IN SIZES UP TO ½"

LEWIS Wire Straightening and Cutting Machines are built for years of hard service. All main drive units are mounted on Timken Roller Bearings. Efficient V Belt Drive is used with motor mounted underneath the machine.

TIMKEN BEARING EQUIPPED

THE LEWIS MACHINE COMPANY
1600 E. 24th ST. CLEVELAND, OHIO

SAYS IT'S A GOOD TIME SAVER

A year ago one Etna Swaging machine was installed by the

Hoskins Mfg. Co. of Detroit

Four additional machines are now in operation in this plant because the management says they are good time savers.

One swager cares for 2-6 head blocks drawing Nickel-chromium wire to 14 to 16 gauge by 3 in. long.

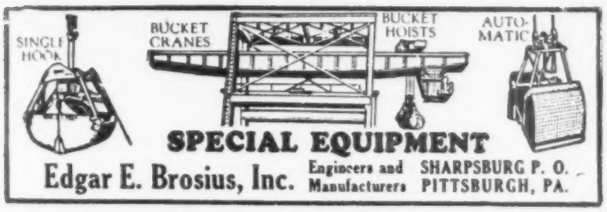
YOUR production problems can be met by

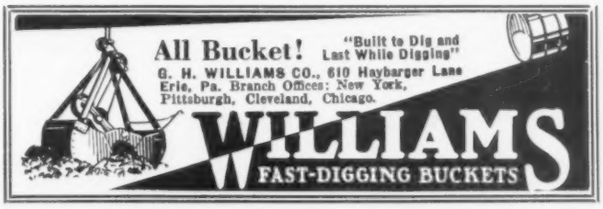
The Etna Machine Co. Toledo, O.

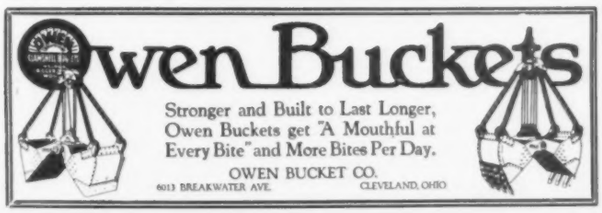


COOK CAP SCREW MACHINES
for shaving CAP SCREWS under and over the head in one operation.
COOK WOOD SCREW MACHINES
For making IRON AND BRASS WOOD SCREWS.
THE ASA S. COOK CO., HARTFORD, CONN.











BEDFORD CRANES
Made in all capacities—Overhead or Gantry —to suit individual requirements. Floor, cage or remote control.
Bedford Steel Stiffleg or Guy Derricks.
Bedford Foundry & Machine Co.
BEDFORD, IND.



Stop These Leaks in 1930

FOLLOW THE NATIONAL LINE

The National Counting and Weighing Machine



If you are now counting parts or pieces by hand, or by weighing and estimating, the National Counting and Weighing Machine will cut your costs 50 to 90%. The operation is entirely automatic. It counts bulk goods accurately and instantly, and registers the total count on the counting bar.

Used in all industries in production, shipping, and receiving departments and for inventory purposes. Accurately counts parts weighing 250 to the ounce, up to heavy forgings and castings. Made in styles and sizes for every counting need.

The National Calling System



Why disturb the workers in several departments, trying to locate one man? Install a National Calling System. It instantly locates the man wanted. It permits the executive to get away from his desk knowing that he can be reached at a moment's notice wherever he goes in the plant.

The National Calling System is extensively used in factories, offices, schools, public buildings, etc. Easily installed, and operates at negligible cost.

National Elevating Scale Trucks



A two-in-one elevating truck that weighs material "on the way". Saves re-handling, and the time consumed in hauling material to separate scales.

The National Elevating Scale Truck combines a complete elevating truck and an accurate National Beam Scale. It quickly weighs platform loads of material without removal from the truck, showing accurate gross, net and tare weights.

NATIONAL SCALE CORPORATION

Makers of
National Counting Machines
National Elevating Trucks
National Elevating Scale Trucks
National Calling Systems
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CHICOPEE FALLS, MASSACHUSETTS

CLIP AND MAIL COUPON

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USERS of BLAW-KNOX products are identified with a large portion of all industrial activity in America. This widespread acceptance is due to the merit of the product—proved by actual usage under various conditions.

BLAW-KNOX products are the fruits of good engineering, backed by long experience and ability to understand and overcome successfully many complicated industrial problems . . . . . increasing production, and lowering operating and maintenance costs . . . . . the aim of modern industry.

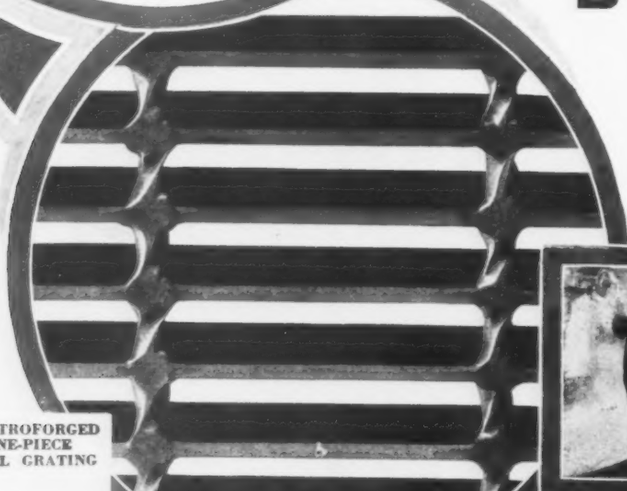
Let us give you the facts.

BLAW-KNOX

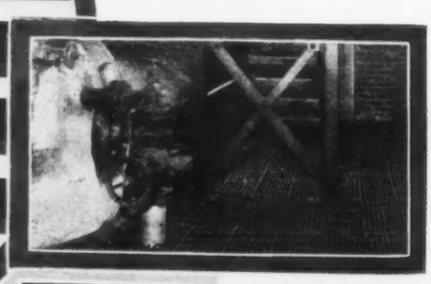
MANUFACTURERS

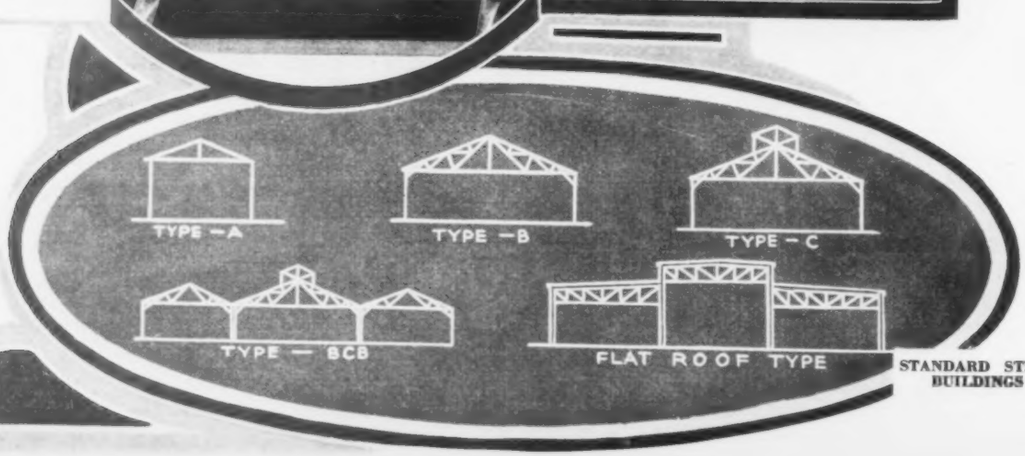
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STANDARD STEEL BUILDINGS

Industrial Products

TRADE MARK BLAW-KNOX REG. U.S. PAT. OFF.

We Manufacture

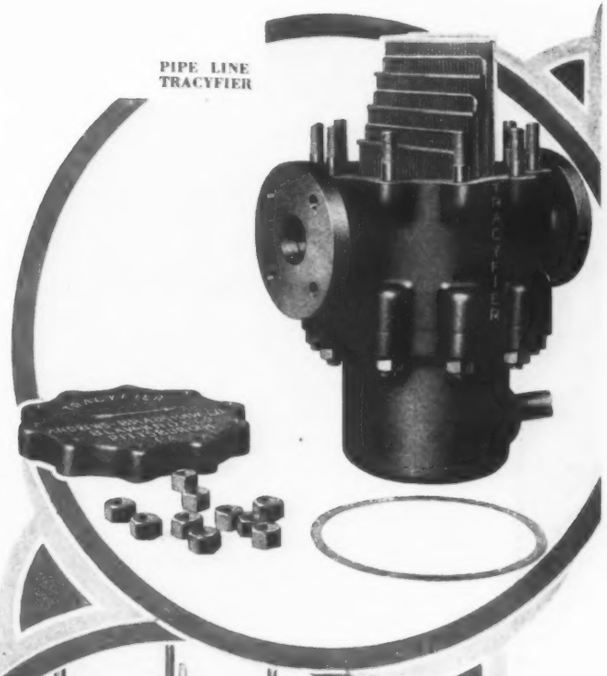
CLAMSHELL AND DRAGLINE BUCKETS
TRACYFIERS (STEAM PURIFIERS)
STEEL GRATING AND OPEN FLOORING
FLOOR ARMORING (FLOORGARD)
AIR PREHEATERS
STANDARD STEEL BUILDINGS
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STEEL MILL BUILDINGS AND MFG. PLANTS
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COMPANY
OF STEEL PRODUCTS

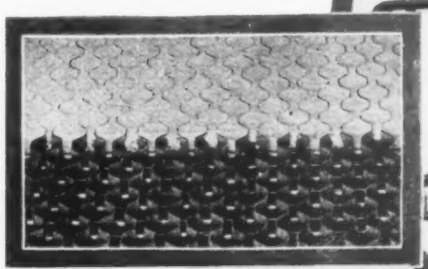
PITTSBURGH, PA.

EXPORT DIVISION

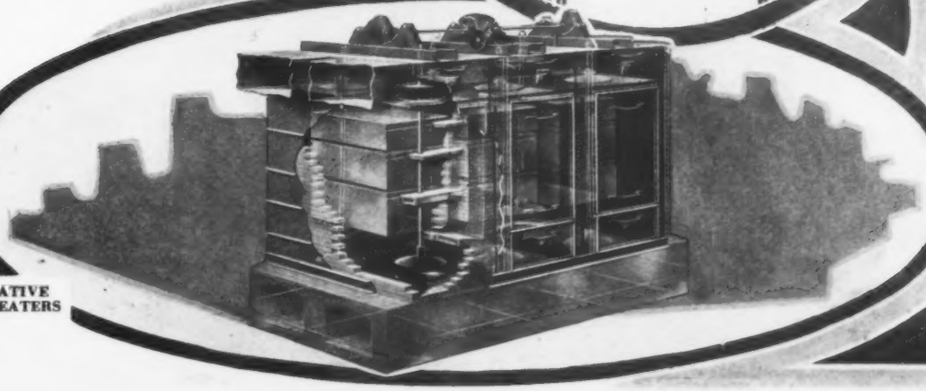
New York, Canadian Pacific Bldg.
London, England, New Oxford House, Hart St. Holborn, W. C. 1. Paris, France, 1 Rue de Clichy
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PIPE LINE TRACYFIER



FLOORGARD-ARMORING FOR CONCRETE FLOORS



REGENERATIVE AIR PREHEATERS

HAYWARD BUCKETS

TRADE HAYCO MARK

HAYWARD BUCKETS

Let a Hayward Electric Motor Clam Shell be a bucket-of-all-work in your plant. Use it to handle one material after another, whether foundry sand or slag, coal, coke, iron ore or scraps.

A handy bucket as well as versatile. Hang it on the crane or hoist hook, plug in the electric cable, and the bucket goes to work. Easy to operate, any one of your regular crane operators can use it.

THE HAYWARD CO.
46-50 Church Street, New York, N.Y.



HAYWARD BUCKETS

TRADE HAYCO MARK

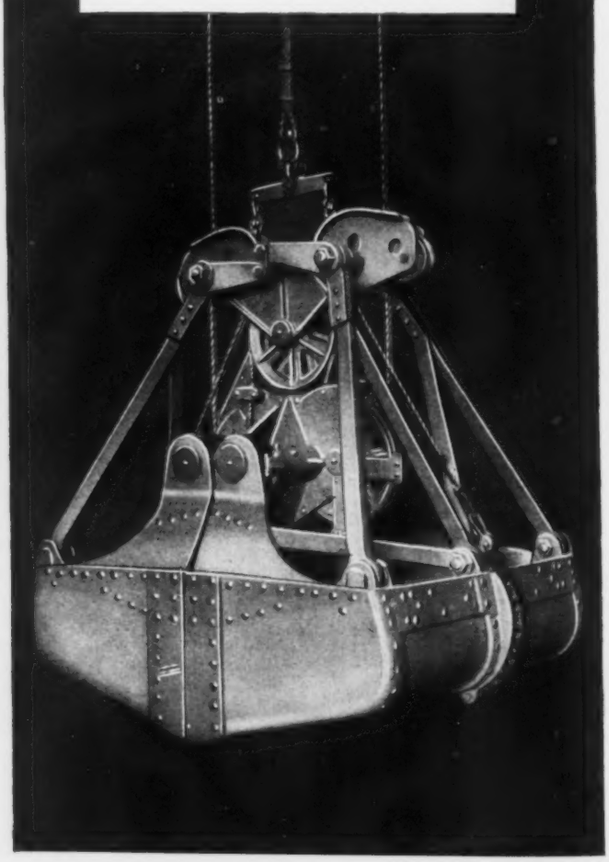
HAYWARD BUCKETS

Power and stamina are the stock in trade of a Hayward Bucket

Rapid digging of big loads . . . ease of bucket operation . . . enduring strength which comes from expert design . . . these are well-known to all who have used Haywards for years.

A Hayward "has everything."

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HAYWARD BUCKETS

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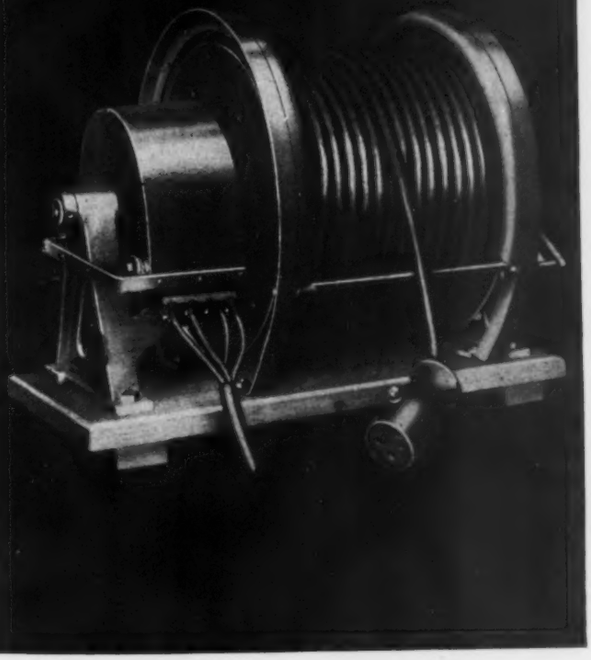
HAYWARD BUCKETS

The Hayward Line includes four separate and distinct types of buckets . . .

Drag line
Clam shell
Orange peel
Electric motor clam shell

These types cover the whole field of grab bucket usage. For this reason, a Hayward engineer can give and does give an unbiased recommendation based upon your own individual needs.

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HAYWARD BUCKETS

Hayward engineers are always available to help you dig facts.

Let these engineers show you how in the coming year and every year after you can make handling costs fall to a new low water mark. Talk over your plant conditions with them. Be assured they will only recommend a bucket fitted to its job in every respect.

THE HAYWARD CO.
46-50 Church Street, New York, N.Y.





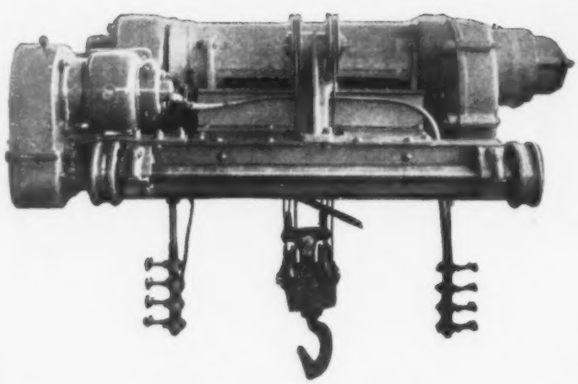
Maris Mono-Rail
Hand or Electric Power

MARIS BROTHERS CRANES-HOISTS

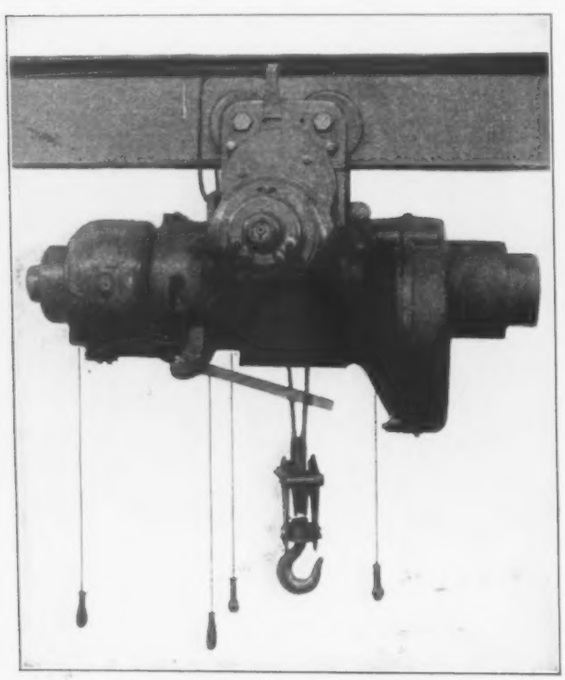
MARIS Brothers Cranes and Hoists have earned their important position on the basis of performance alone.

Performance resulting from scientific design, careful workmanship, and the right material.

And one of their big features is ability to keep going under adverse conditions.



Maris Diamond M Hoist
for Double Beam Cranes



Electric Hoist for Single Beam Crane
or for Monorail Systsem

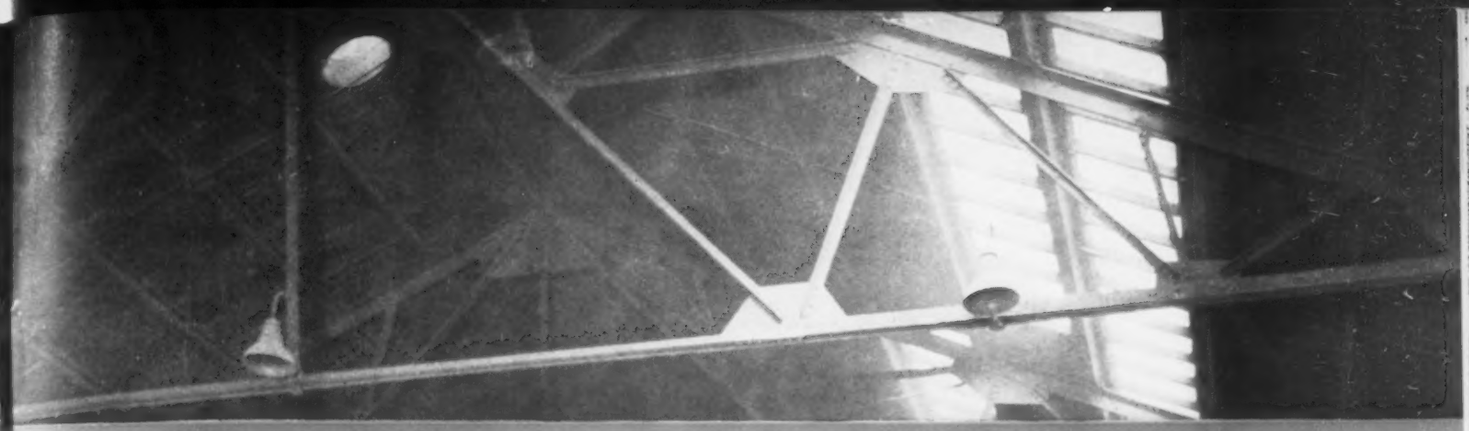
Equipment for every hoisting requirement

Our Catalog contains some useful data— have you a copy?

MARIS BROTHERS

Incorporated

5538 Grays Ave., Philadelphia, Pa.



Tigers are Earning Their Service Stripes

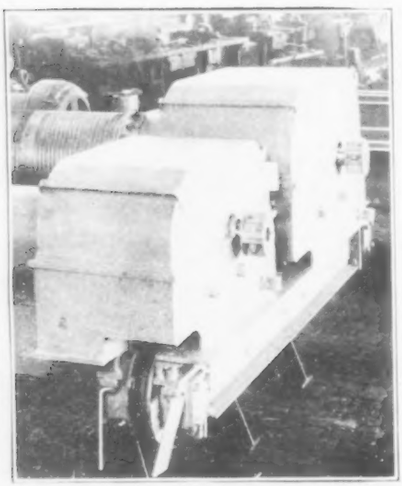


Patent applied for

WHITING



24 Hours a Day for 6 Months— Typical Tiger Performance



Oil-Tight Gear Cases

All gears and gear bearings are completely enclosed in welded steel housings that are absolutely oil-tight. The upper half of this case is removable—providing easy accessibility for routine inspection.

Only in the Tiger Will You Find all of These New Features

Herringbone Gears
Hyatt Roller Bearings
Oil-Cooled Mechanical Brake
Oil-Bath Lubrication of Gears
Alemite Bearing Lubrication
Welded, Oil-Tight Gear Cases
One-Piece Gatke Brake Shoes
Welded Trolley Frame
Welded Truck Ends
All-Steel Diamond Tread Footwalk, Full Length of Bridge
"Safety-First" All Enclosed Switchboard
No Overhung Gears
One-Piece Steel Casing for All Bearings in Each Gear Train
Thomas Flexible Couplings
All Parts Quickly Accessible
Standard Parts Carried in Stock
Flexible Design Adaptable to All Conditions.

A STEEL foundry operated its TIGER 24 hours a day for six months during peak production. A breakdown of any sort would have been costly. "We are glad", said this customer, "that we had this dependable crane—the only one of our six cranes that is always ready". Since then this customer has put TIGER trolleys on two of their old cranes.

A foundry in Ohio saves $300 a month on its TIGER crane. This represents overtime saved by the TIGER doing the same work in less time than their old crane.

In a plant near Chicago, no oil was added to the gear case until 11 months after it was erected—yet the TIGER performed so satisfactorily that this is one of our most enthusiastic customers.

Others say: "It's the finest crane I have ever seen".

"Our shop recommends the TIGER crane very highly".

"It has paid for itself in 6 months".

Continuous operation with minimum attention—low operating costs—little maintenance—higher speed (where required)—more work per hour—smooth silent action! That is how the TIGER is earning its service stripes.

You will understand this enthusiasm when you read the story of TIGER crane construction as told in "The Tale of the TIGER". The complete information in this bulletin—including clearance tables and a partial list of users—points the way to lower crane costs and a new era of performance.

Send for it today.



WHITING CORPORATION
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"SOUND ADVICE—GET A CONCO PRICE"

There's a Type and Size for Every Need from One-Quarter to Twenty Tons Capacity.



A CONCO 5 ton, three motor, single I-Beam cab operated crane with Lo-Hed Hoist.

WRITE FOR NEW CRANE AND TROLLEY CATALOGUE No. 110

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CRANES *and* TROLLEYS

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MORGAN
for Steel Plant Equipment

Premier exponent of sound construction in heavy machinery; Pioneer in improved design; Authority in the solution of difficult engineering problems.

Electric Overhead Traveling Cranes of All Types and Sizes

Gantry Cranes
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Steam Hammers of Every Description
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High Speed Steam Hydraulic Forging Presses

Electric, Hydraulic and Power Punches and Shears

Bending Machines
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Vertical and Horizontal Slab and Ingot Charging Machines

Open Hearth Charging Machines, Floor and Overhead Type

Screw Type Ingot Strippers
Heavy Rolling Mill Machinery
Morgan Reversible Electric Controllers
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Special Machinery for Bessemer and Open Hearth Furnaces and Rolling Mills

Blooming Mills
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Rock Crushers
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Tire Mill Plans Complete
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Steel Plants Complete
Structural Work
Brass Castings
Heavy Forgings
Safety Limit Stops for Crane Hoists

THE MORGAN ENGINEERING COMPANY
ALLIANCE, OHIO, U. S. A.

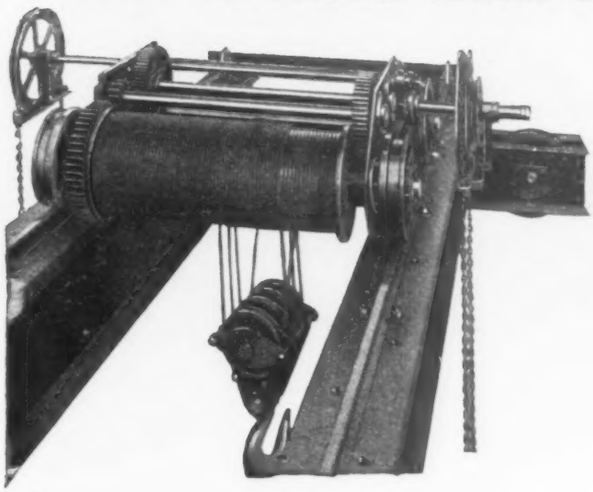
Bulletins and Catalogs on Every Line

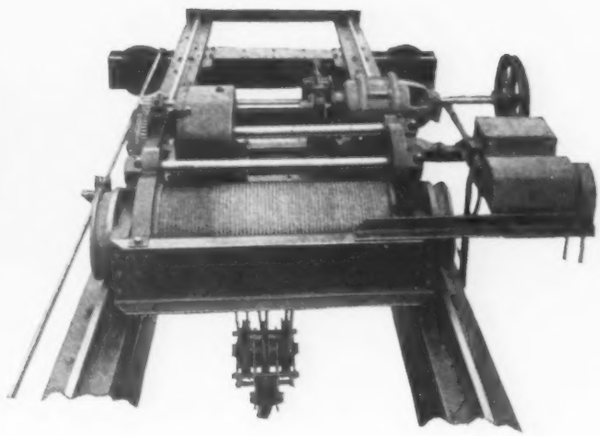
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Designers, Manufacturers and Contractors

Hand Power and Electric Cranes, Jib Cranes and Monorail Systems

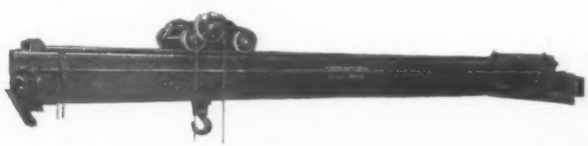






ELECTRIC TRAVELING CRANES

Electric Traveling Cranes are furnished for capacities from 5 to 40 tons, standardizing principally on moderate speed cranes. The load brake and high speed gears are inclosed in oil casing. High pressure lubrication for all journals. Electric solenoid brake on motor shaft. If a one-, two-, or three-motor crane is needed and high speeds are not essential, we can offer a high quality crane at favorable price.

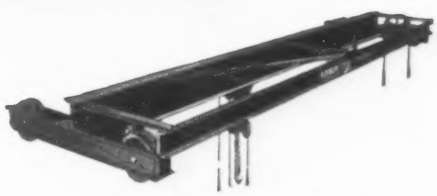


MONORAIL TROLLEYS

Monorail Trolleys are carried in stock for capacities from ¼ to 10 tons. High quality ball and roller bearings insure best operating qualities. We make complete installations of overhead monorails, including track, curves, switches, turntables, hangers, etc., and erect when desired.

DOUBLE GIRDER HAND CRANES

Double Girder Hand Cranes are built in capacities from 2½ to 40 tons for all spans. Top running trolley hoist provides maximum lifting height and best degree of smoothness and efficiency in operation. The load is carried on roller bearings throughout and all gearing is the spur type cut from the solid. Two speeds for hoisting and lowering the load are provided.



SINGLE GIRDER HAND CRANES

Single Girder Hand Cranes are built in capacities from 500 pounds to 10 tons. Roller bearings carry the load and gearing is the cut tooth spur type. An outboard channel with diagonal bracing to the beam provides substantial support for squaring shaft and lateral reenforcement. Cranes can be supplied with or without trolleys and chain blocks as required.



Self-Supporting Jib Crane, One-Ton Capacity, 16-Ft. Reach.

Jib Cranes furnished in following types:

Mast type for anchoring to floor and ceiling. Bracket type for attachment to wall or column.

Self-supporting type for mounting in concrete base.

Traveling wall type for traveling on three rails on wall.

Advise type required, capacity, effective reach overall height, and clear height below boom.



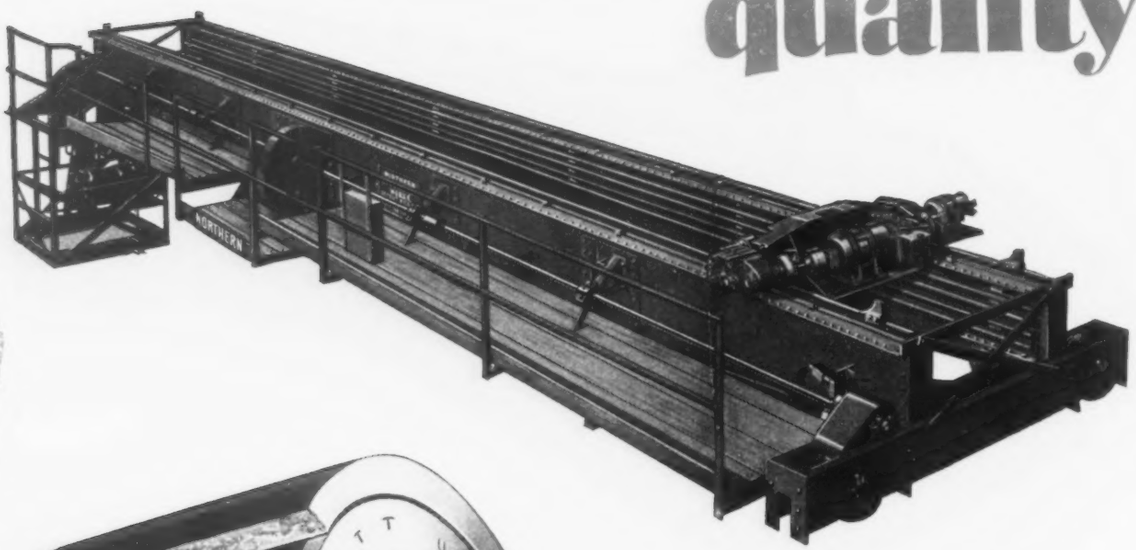
Four Traveling Wall Cranes on the Same Runway

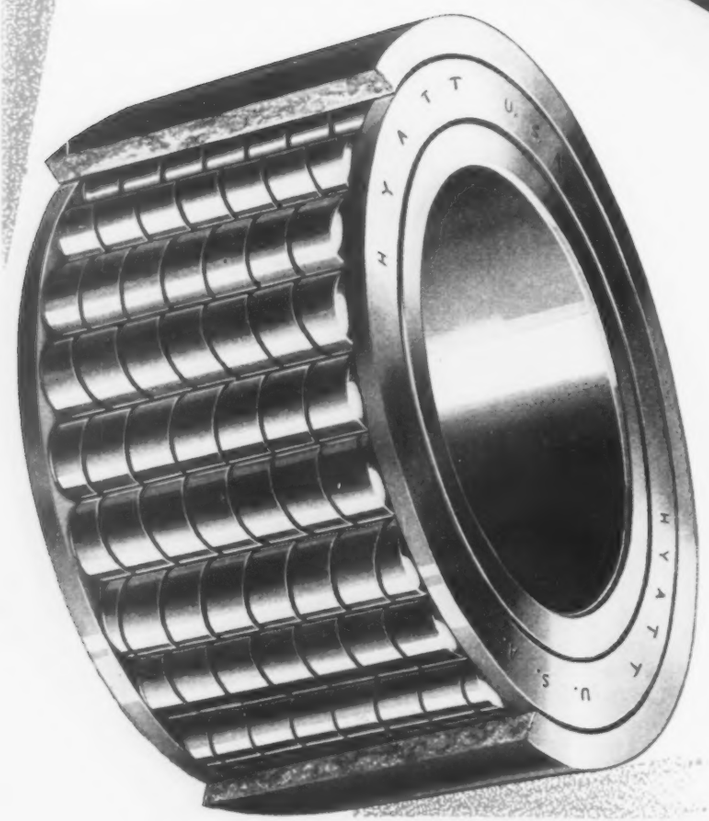
THE ARMINGTON ENGINEERING CO.

EUCLID, OHIO

NEW YORK CITY CHICAGO PHILADELPHIA PITTSBURGH NEW ORLEANS ST. LOUIS DENV

power economy quality





NORTHERN
Roller Bearing Cranes
for Modern Service

QUICK acceleration and deceleration—ease of handling—low power cost—these and other outstanding engineering features are yours in Northern Cranes.

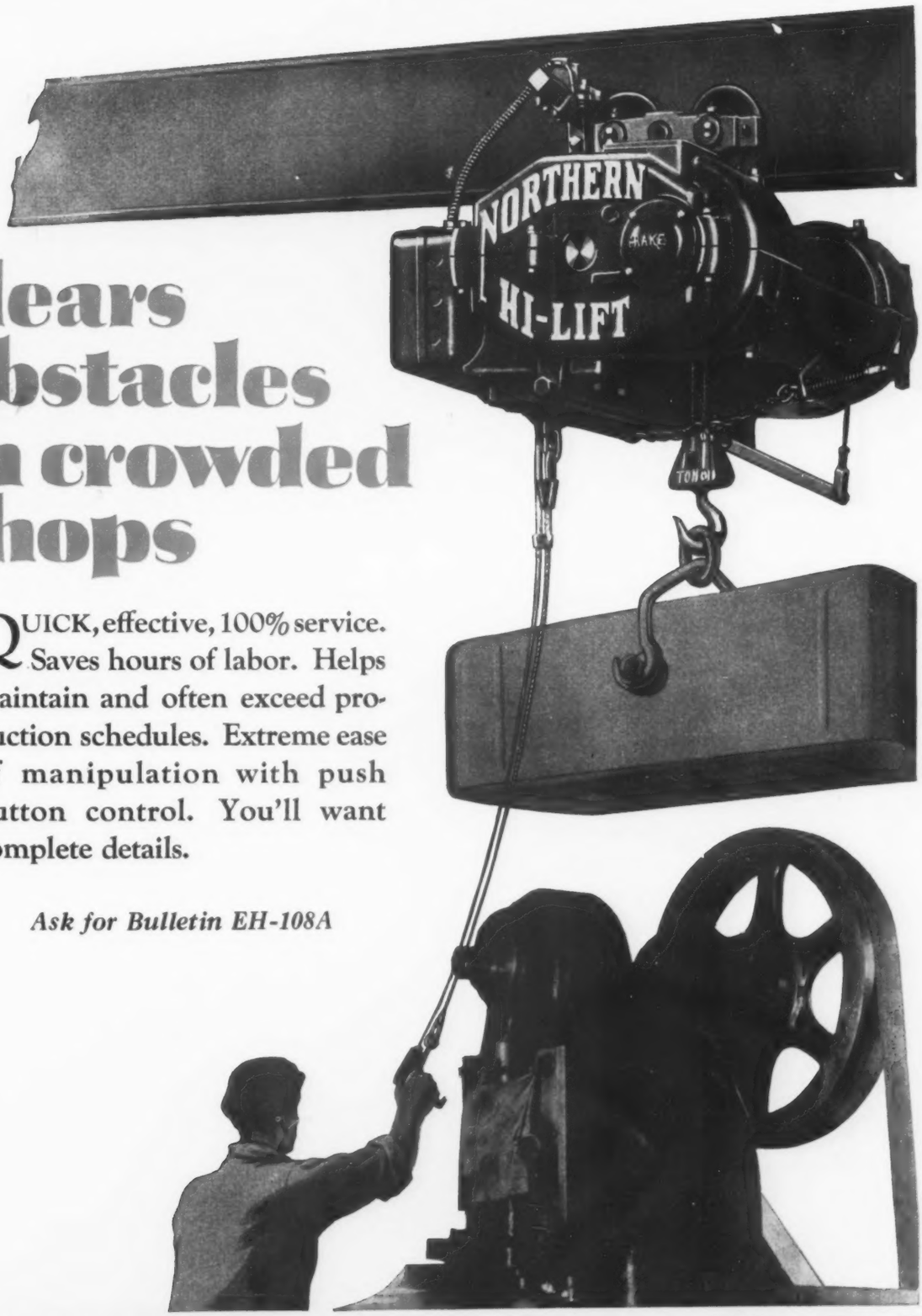
Built with ROLLER BEARINGS from trucks to bottom block.

A type and size for every service.
Ask for Bulletin HLE-101A

NORTHERN ENGINEERING WORKS
DETROIT - MICHIGAN

NORTHERN
ROLLER BEARING CRANES

CA-1



clears obstacles in crowded shops

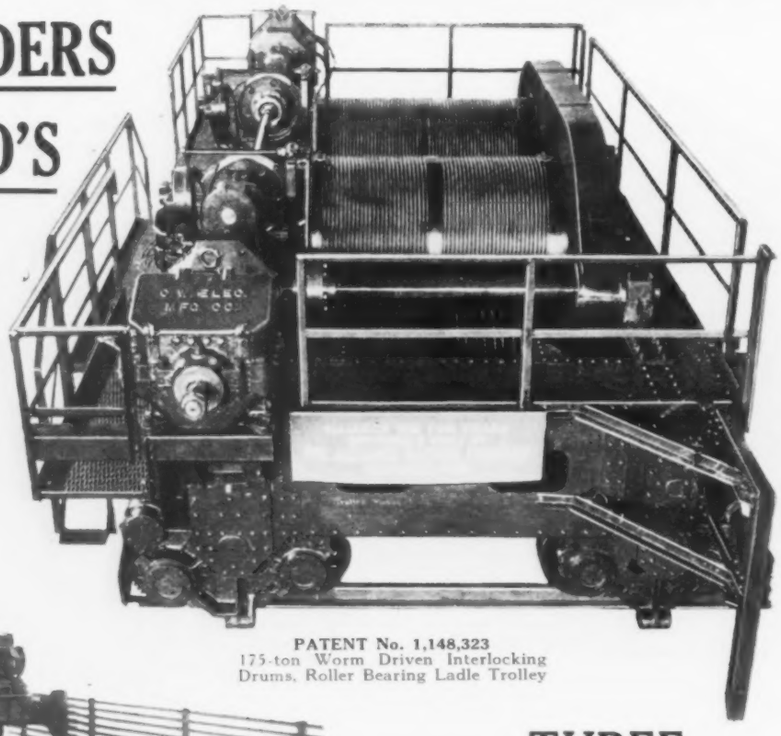
QUICK, effective, 100% service. Saves hours of labor. Helps maintain and often exceed production schedules. Extreme ease of manipulation with push button control. You'll want complete details.

Ask for Bulletin EH-108A

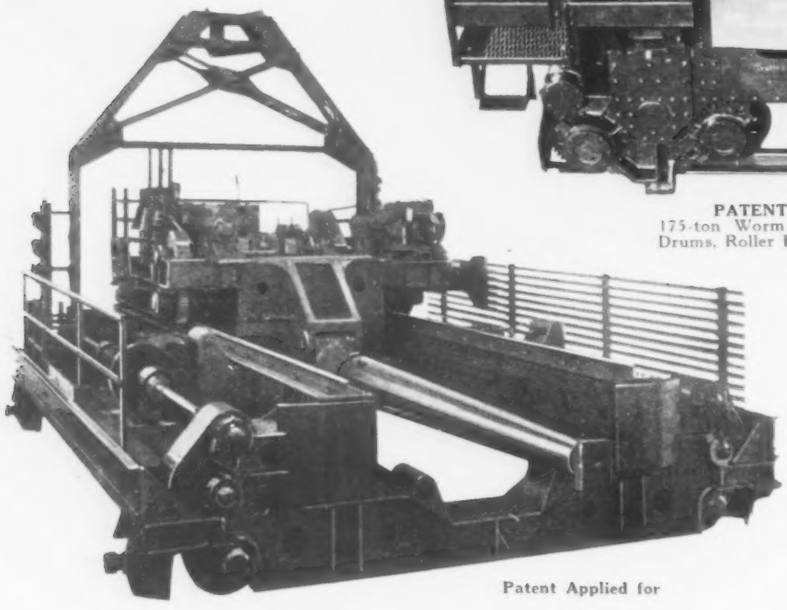
NORTHERN
ROLLER BEARING HOISTS

HA-1

LARGEST BUILDERS OF THE WORLD'S LARGEST CRANES



PATENT No. 1,148,323
175-ton Worm Driven Interlocking Drums, Roller Bearing Ladle Trolley



Patent Applied for

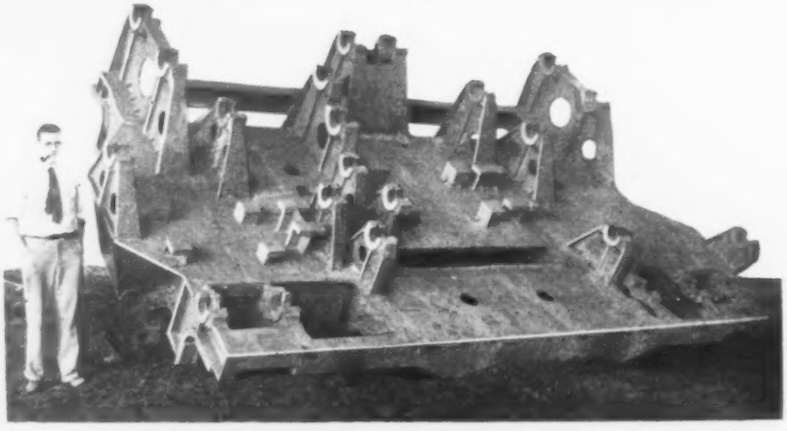
THREE IMPORTANT ORIGINATIONS *By* ALLIANCE

5 Ton Worm Driven Roller Bearing Floor Charger

Alliance Products

STANDARD CRANES
Up to 430 tons capacity
STRIPPING CRANES
Up to 320 tons capacity
COMBINATION CHARGERS and STRIPPERS
Up to 200 tons capacity

Ladle Cranes
Ingot Strippers
Soaking Pit Cranes
Open Hearth Charging Machines
Slab and Billet Charging and Drawing Machines
Gantry Cranes
Ore and Coal Bridges
Car Dumpers
Forging Manipulators
Steam Drop Forge Hammers
Coke Pushers, Levelers and Door Lifters
Coal Pier Equipment
Rolling Mill Machinery
Cement Plant Machinery
Dock Handling Equipment
Coke Oven Equipment



One Piece Cast Steel Trolley
All parts cast from one pattern, thereby insuring rigidity and alignment.

Give Us the Runway and We Will Lift the World

THE ALLIANCE MACHINE CO.

ALLIANCE, OHIO, U. S. A.
ENGINEERS AND BUILDERS

EUCLID
CRANES HOISTS
"Raise Profits"



Cut production costs

Where time and money are involved, the production man turns to EUCLID.

EUCLID Cranes and Hoists are not limited to any particular field or kind of work. We build cranes in one, two or three motor styles, single and double girder types, for floor, cab, or remote control in capacities from ½ to 30 tons.

In the electric hoist field we build a very complete line in capacities from ½ to 20 tons, in all types and sizes.

Also there is the Hercu-Lift, the smallest member of the EUCLID Line, with a capacity of 500 lbs., and a lifting speed of 50 ft. per minute.

Whatever the job, there is a EUCLID Crane or Hoist built to stand up under the most severe tests and conditions. It will provide maximum service with a minimum of maintenance expense.

If you are interested in lowering your costs, write us. We have interesting literature describing the construction of our Cranes and Hoists—it also gives the experiences of many users.

One large user of EUCLID Equipment reports an annual saving of —"Nearly ten times the original cost of the Hoists." Another user reports—"Our EUCLID Crane is saving us $14,000 annually . . ." Still another that—"The operating cost of our EUCLIDS is so small that it can be disregarded."

These letters show the real merit behind EUCLID Cranes.

THE EUCLID CRANE AND HOIST CO.
Euclid, Ohio



POWERFUL Lifting Magnets
cost no more

When buying lifting magnets, bear in mind that lifting capacities depend largely upon the weight of the principal ingredients—namely the amount of copper and steel furnished in a magnet.

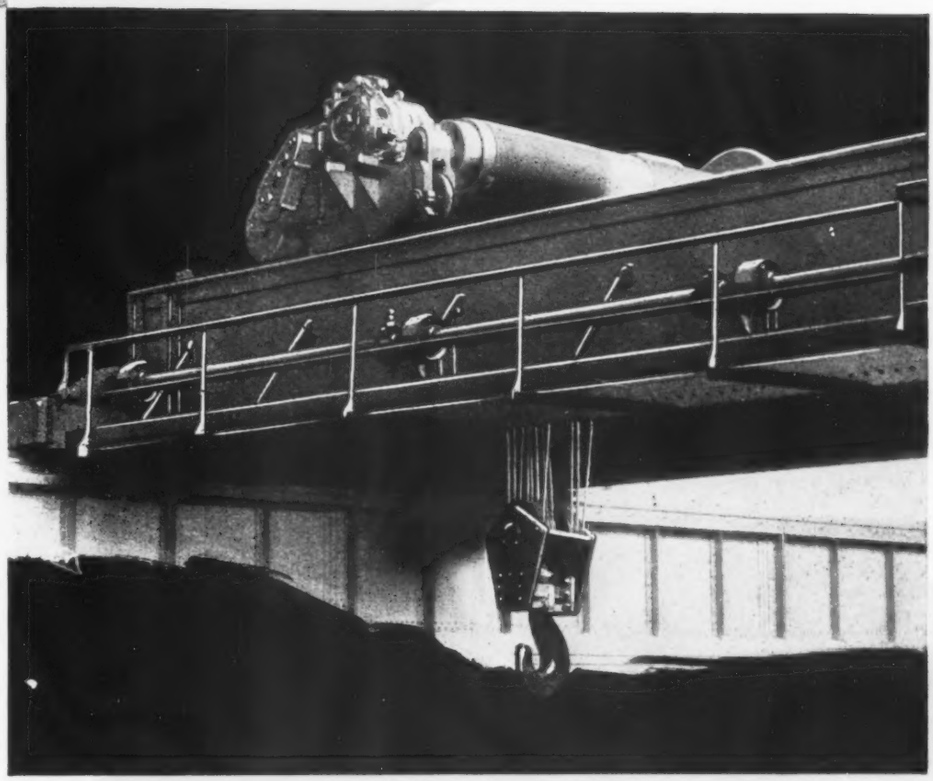
That is why the greater weight of EC&M Lifting Magnets insures more powerful lifts not only for a few operations, but for every operation throughout the day.

Write for a copy of Bulletin 900-I which proves that EC&M Lifting Magnets offer you more magnet per dollar invested than ever before.

The Electric Controller and Manufacturing Co.

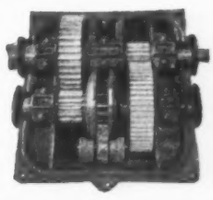
Cleveland, Ohio

ROLLER BEARINGS THROUGHOUT



...with the Niles compact reduction-gear and load brake design

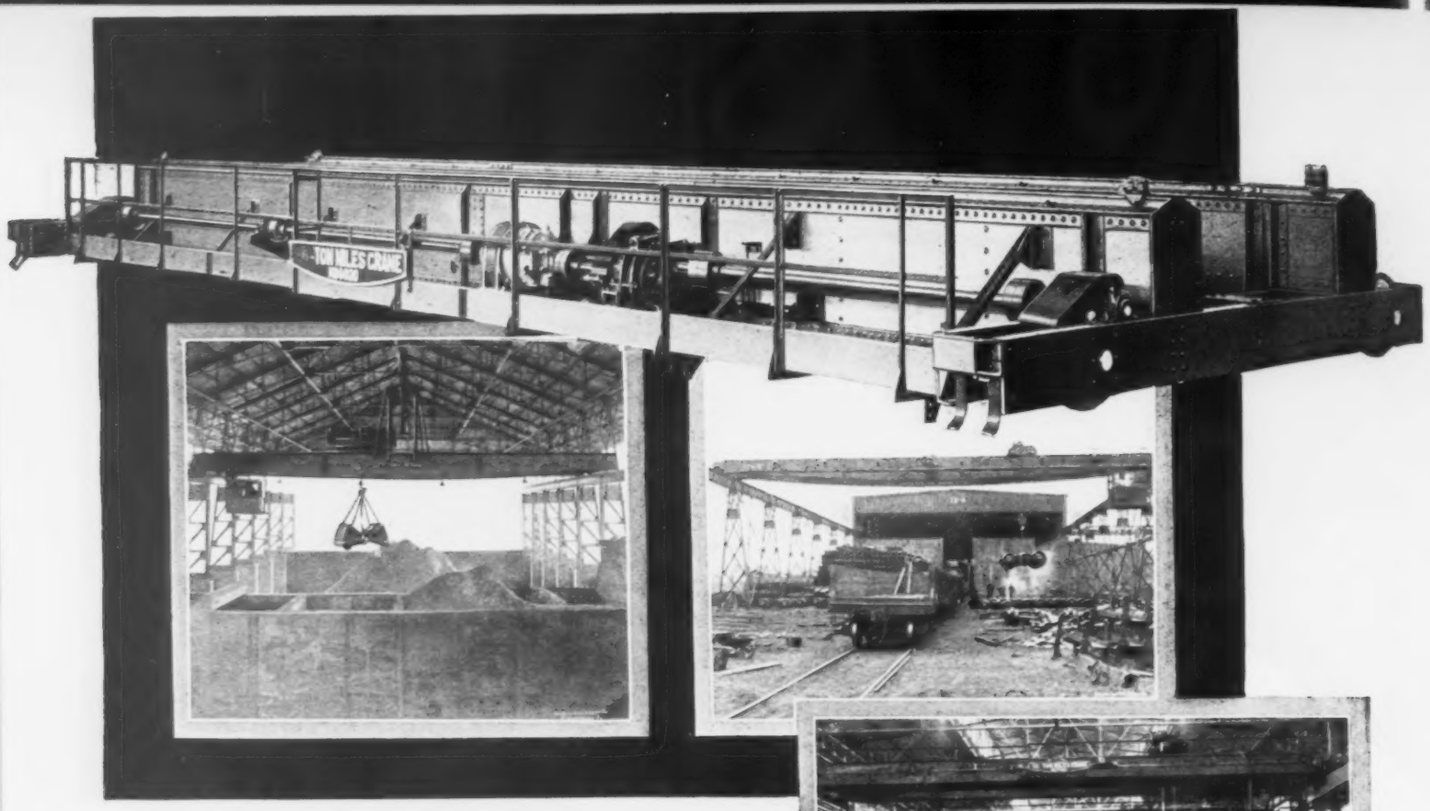
Here's a crane that assures lasting efficiency of performance and reduces maintenance to a minimum! It's fortified with roller bearings at every rotating support...

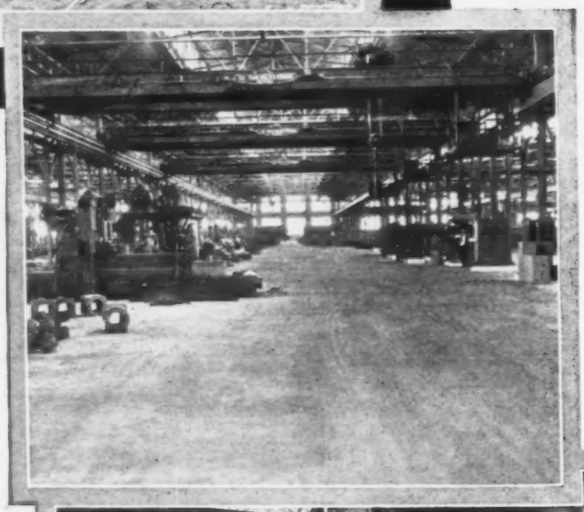


Niles Compact Reduction-Gear, Load-brake and bearing rigidly supported by a unit casting.

SHEPARD NILES CRANE AND HOIST CORPORATION
356 Schuyler Avenue · · Montour Falls, N.Y.
Works: Montour Falls, N.Y. Philadelphia, Pa.

NILES CRANE DIVISION







Reduce maintenance to a minimum with NILES ROLLER BEARING CRANES!

Friction-free to an unexcelled degree and with it a greatly reduced need for lubrication and inspection. That's what Niles now offers in the compact reduction-gear and load-brake design by fortifying every moving support with anti-friction bearings.

No matter what the crane service may be, whether indoors or out, this added feature of Niles design will be welcomed by crane users. It is typical of the thorough, competent designing that is evidenced in every detail of Niles Cranes, the combination of which serve to give industry the unfailing, low cost load handling that is typically Niles.

Our engineer representatives who are located in the principal cities from coast to coast will be glad to give you complete information.

SHEPARD NILES CRANE AND HOIST CORPORATION
356 Schuyler Avenue · · Montour Falls, N.Y.
Works: Montour Falls, N.Y. Philadelphia, Pa.

NILES CRANE DIVISION

Member EMA

OHIO LIFTING MAGNETS

for economical handling of either HOT or COLD Steel

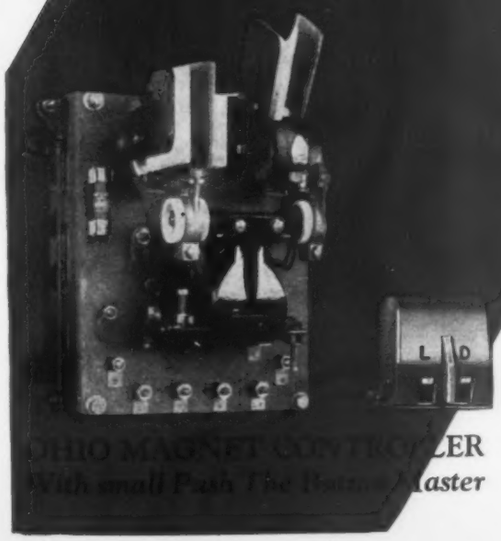


IF you choose your lifting magnets on past performances, you will be interested in the almost 100% service Ohio Lifting Magnets are giving to others.

In foundries and steel mills they are being subjected to intense heat—loading cupolas, handling hot ingots, billets, and hot rolls of strip steel.

The all-asbestos insulation, double protection of leads and terminals fortify them against external heat or internal heat generated by continuous operation, assuring long life and low maintenance cost.

Ohio Magnets are built in a number of sizes and capacities that will meet almost any requirement. And they are all guaranteed.



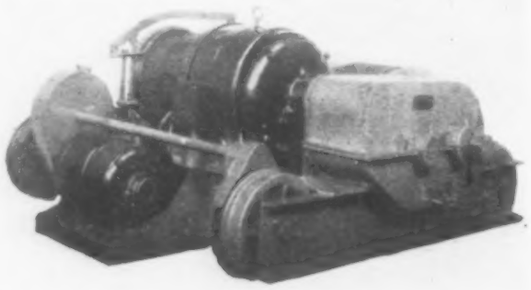
OHIO MAGNET CONTRO[illegible]LER
With small Push Button Master

GUARANTEE

All magnets furnished by this company are guaranteed to be free from electrical and mechanical defects for a period of one year from date of shipment, and we agree to repair or replace any magnet in which such defects develop, under normal operation within that time.

The OHIO ELECTRIC & CONTROLLER CO.

5908 Maurice Av. Cleveland, Ohio



HY-HOOK
ELECTRIC CRANES and HOISTS

Equipped with:
High Duty Roller Bearings
Alemite Pressure Lubrication
Hardened Steel Pinions
Forged Steel Gears

Built of:
All Steel Arc-Welded Construction.

We are the pioneers of each and all of these super-excellent features of modern crane equipment.

THE AMERICAN CRANE CO., Inc.

Main Office and Factory
FRIENDSHIP, N. Y.

New York Office
30 Church Street



Of course you want the best, then buy "AMERICAN HY-HOOK"

SAVE Time, Labor and Money



Ohio Locomotive Cranes have proved their ability to handle material with greater speed at less cost per ton, wherever they have been installed.

Rugged, efficient and dependable—one Ohio Crane will replace a large gang of laborers at a big saving of time and money. There is a crane to fit your need.

All major parts made of one-piece open hearth steel castings. Gears and pinions of high carbon steel. All major castings are backed by a 10-year guarantee.

We build Locomotive, Wharf, Gantry, Barge, and Logging Cranes. Steam, Gas, or Motor Driven

SALES OFFICE AND FACTORY

BRANCH OFFICES:
New York, N. Y.
Pittsburgh, Pa.
Chicago, Ill.
St. Louis, Mo.
Detroit, Mich.
Birmingham, Ala.
New Orleans, La.

THE OHIO LOCOMOTIVE CRANE CO.
OAK ST., BUCYRUS, OHIO

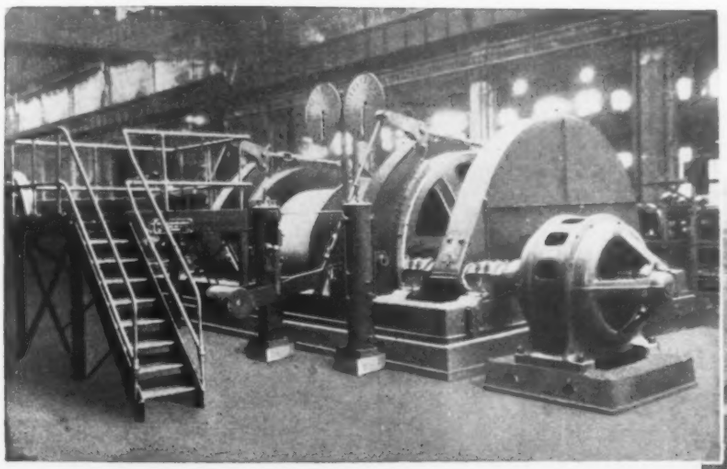
BRANCH OFFICES:
San Francisco, Cal.
Portland, Ore.
Seattle, Wash.
Vancouver, B. C.
Winnipeg, Man.
Toronto, Ont.
Montreal, Que.



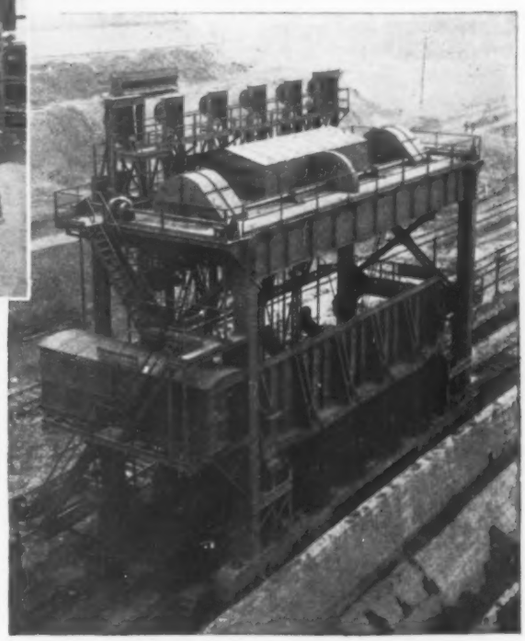
Machinery for Iron and Steel Production

from

Ore Mines to Finished Product



Electric Hoist



Movable Car Dumper

A BACKGROUND of more than fifty years of specialization in designing and building equipment for the iron and steel industry—and a highly efficient engineering department—qualifies us to economically solve all problems that arise in your production and handling operations.

Wellman Products Include:

Steel Mill Equipment
Coal and Ore Handling Equipment
Gas Producers, Valves, Flues, etc.
Special Cranes
Hoisting Machinery for Mines
Port and Terminal Equipment
Castings and Machine Work to Customer's Drawings
Car Dumpers—all types

THE WELLMAN-SEAVER-MORGAN CO.

ENGINEERS CONSTRUCTORS MANUFACTURERS

Cleveland, Ohio

New York at 30 Church St., Birmingham, at 1101 American Trust Bldg.
Chicago at Room 523—549 West Washington Blvd.
In Canada—"Canadian Wellman-Seaver-Morgan Co., Limited," 307 Reford Bldg., Toronto—821 Castle Bldg., Montreal
Mexico City at Edificio Oliver, 16 De Septiembre No. 5

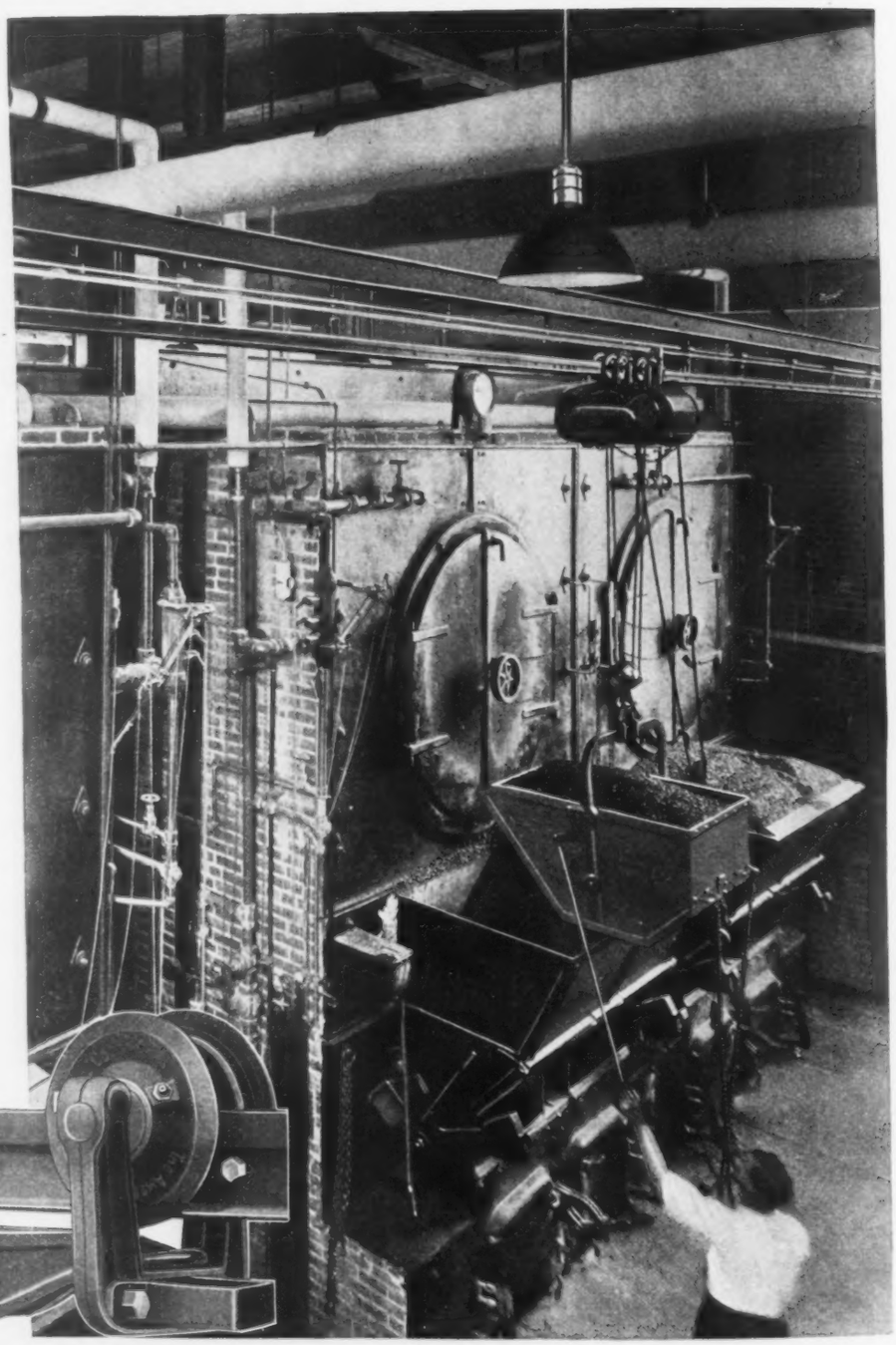
Be Air-Minded
With MonoRail in 1930

PUT in the air all that moving tonnage that will travel through your plant in 1930.

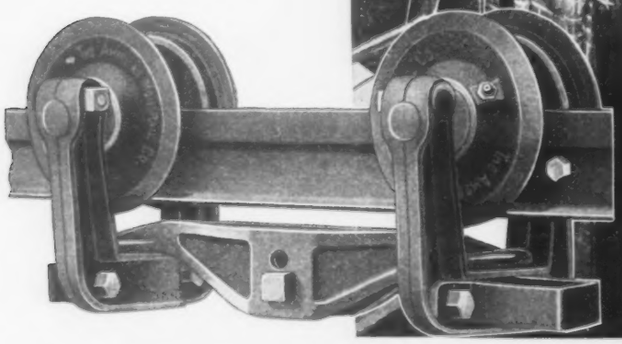
MonoRail will lift and carry your material, raw, in process or finished, from building to building, floor to floor, room to room, machine to machine, picking it up or spotting it anywhere on the line.

Hung from the ceiling or convenient superstructure. American MonoRail dodges columns, piping, belting and all overhead obstacles; leaves floors and aisles clear for machine operations and necessary traffic.

Low initial cost; freedom from maintenance or upkeep expense; and the immediate returns from its use urge your consideration of American MonoRail Overhead Conveying Systems in 1930.

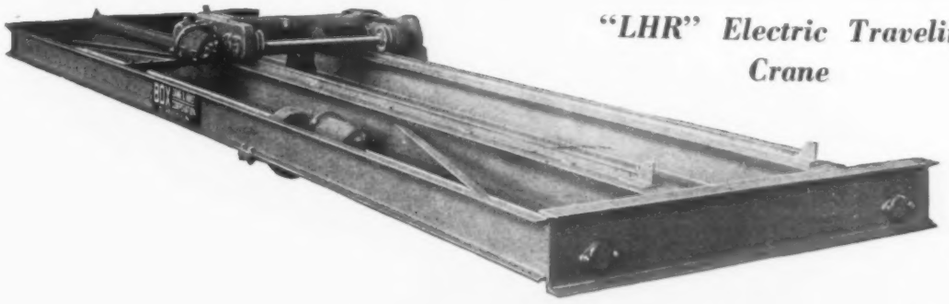


THE illustration shows an American MonoRail System handling fuel to automatic stokers in a Philadelphia, Pa., boiler room. Bucket has a capacity of 21 cu. ft.

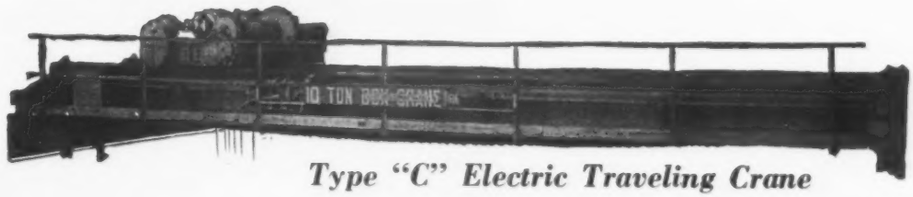


THE AMERICAN MONORAIL CO

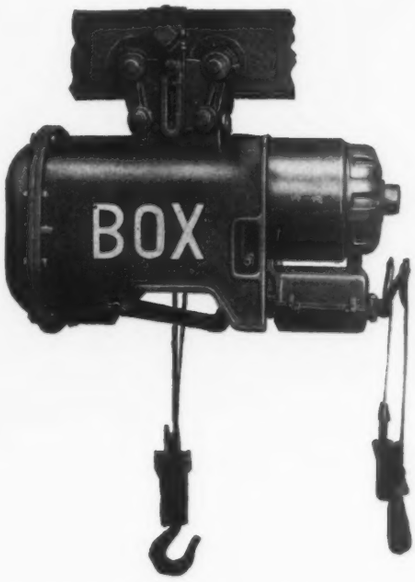
13104 ATHENS AVENUE *Distributors in all Principal Cities* CLEVELAND, OHIO



"LHR" Electric Traveling Crane



Type "C" Electric Traveling Crane



"*Load Lifter*" Electric Hoist

Box "Load Lifter" Electric Hoists are small, compact and strong hoisting tools, operating on AC or DC, with accurate load control; they are equipped with 1-point forced feed and splash lubricating systems; impervious to moisture and fumes . . . capacities, 1,000 lbs. to 5 tons. Write for details.

BOX!

a synonym for . . . . . .
Hoisting Equipment

Box Type "C" Heavy-duty Electric Traveling Cranes are in use wherever difficult service conditions require cranes that stand the gaff continuously . . . Type "C" cranes are standardized—made from only three frame sizes of machinery units, produced in large quantities at mass production costs . . . and sold at a price no greater than other good cranes.

Likewise the Box "LHR" (low-headroom) cranes are standardized, for spans up to 50 feet, and loads of one, two and three tons; arc-welded, all-steel construction throughout—operates in less space and gives greater hook approach in all directions than any other *standard* crane.

Electric Traveling Cranes

Grab Bucket Operating Cranes

Hand-Operated Traveling Cranes

BOX CRANE & HOIST CORPORATION

E. Ontario and Janney Streets

PHILADEPHIA, PA.

Established 1878

"One of the Pioneer Crane Builders"

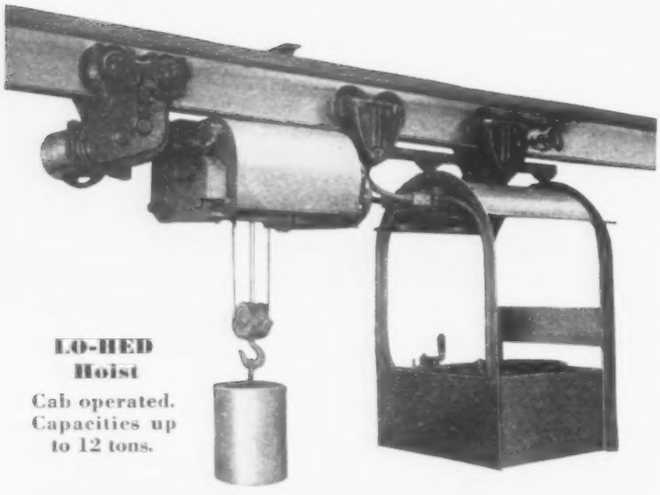
Electric Hoists

Monorail Hoists

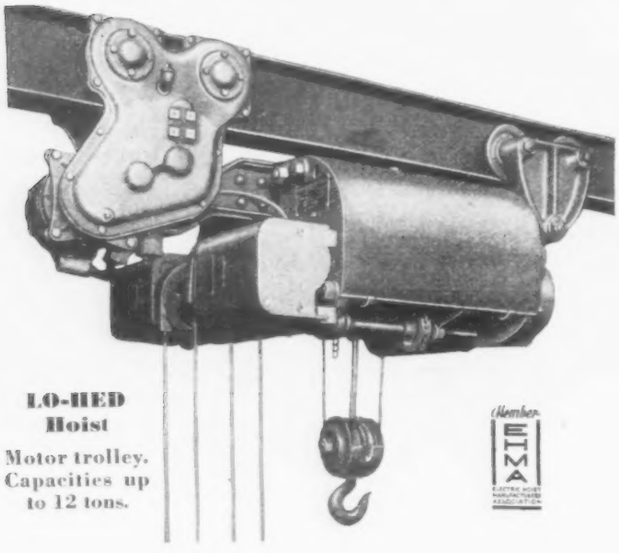
Jib Cranes

Special Cranes For Special Conditions

For 1930—
figure electric
in your



LO-HED Hoist
Cab operated. Capacities up to 12 tons.



LO-HED Hoist
Motor trolley. Capacities up to 12 tons.

Member EIMA

Now, when you are making budgets and preparing for 1930 production, is the time to insure for *your* business the money-saving, time-saving economy of electric hoisting.

A LO-HED Hoist, operating on an overhead runway, does more work than many men. It not only reduces labor costs, but by speeding up the handling of materials it enables you to get more out of your other equipment.

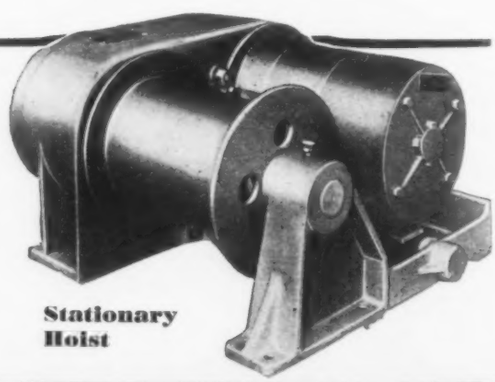
A LO-HED puts your ceiling to work for lifting and moving all kinds of loads and releases valuable floor space for other purposes. It operates in minimum headroom and increases the capacity of storage space by stacking articles almost to the ceiling.

Built by a company with an international reputation as a manufacturer of fine machinery, the LO-HED is a thoroughbred among hoists.

Every Lo-Hed is a heavy duty hoist. They are made in capacities up to 12 tons. A type for every requirement.

Stationary Hoist

The simplicity and handiness of the Stationary Hoist give it a wide field of usefulness in scores of industries. It is used for lifting and pulling, mounted in a fixed position, on the ground or overhead. When used for lifting, it can be bolted to an overhead beam or the cable run over a sheave or the hoist can be used in connection with a crane or derrick. The stationary hoist provides a convenient means of pulling a load up an incline. In whatever way it is used, it soon pays for itself many times over.



Stationary Hoist

LO-HED PATENTED

hoisting economy budget program

Direct spur gear drive oil bath lubrication . . . Hyatt roller bearings . . . ball-bearing motors, designed especially for hoist service . . . short shafts of high carbon steel . . . automatic lowering brake . . . quick-acting holding brake . . . these are just a few of the many valuable features of LO-HED design. The LO-HED will operate on any make of monorail or tramrail.



Quarter-Ton LO-HED

(Illustrated at the right)

This light, handy hoist brings the advantages of electric hoisting within reach of every business.

Steel-built, wherever steel can add to strength or reduce weight, it does the work of several men faster and cheaper.

Swift, easily controlled, economical, the quarter-ton Lo-Hed has a thousand and one uses where larger hoists would not be practicable.

In factory, warehouse, garage or shop, on the shipping platform, lifting work on or off of machine tools, for light assembly jobs . . . it quickly pays for itself.

Check these features: Pressed steel frame, push button control, ball bearing throughout, oil bath lubrication, working parts completely enclosed, non-spinning cable, chrome-manganese gears and shafts, powerful brakes, weight 225 pounds.

It's quality-built throughout, yet priced so reasonably that *any business that can afford a typewriter or a cash register can afford a quarter-ton Lo-Hed Electric Hoist.*

Write for literature

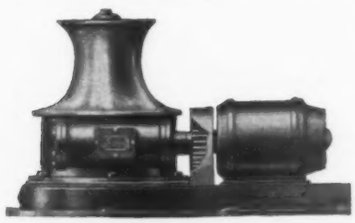
American Engineering Company

AMERICAN ENGINEERING COMPANY PHILADELPHIA AE CO

2410 Aramingo Ave., Philadelphia

Export office: 30 Church Street, New York

In Canada: Affiliated Engineering Companies, Ltd. Head Office, Southam Bldg., Montreal



Car Puller

A powerful, fast machine for spotting freight cars...Write for details.

AMERICAN ENGINEERING CO.
2410 Aramingo Ave., Philadelphia, Pa.

Please send me information about the items checked.

Name.....

Company.....

Street.....

City.....*State*.....

(Don't forget the check mark)

✓ CHECK HERE

☐ Quarter-Ton Hoist

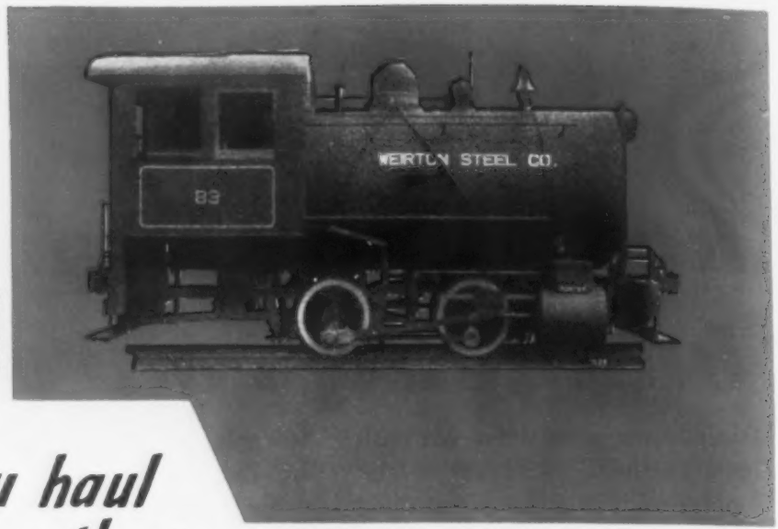
☐ Hoist for.....lbs.

☐ Stationary Hoist

☐ Car Puller

☐ Marine Hoists

(10-1-30)



Can you haul for less than .0078 cents per ton?

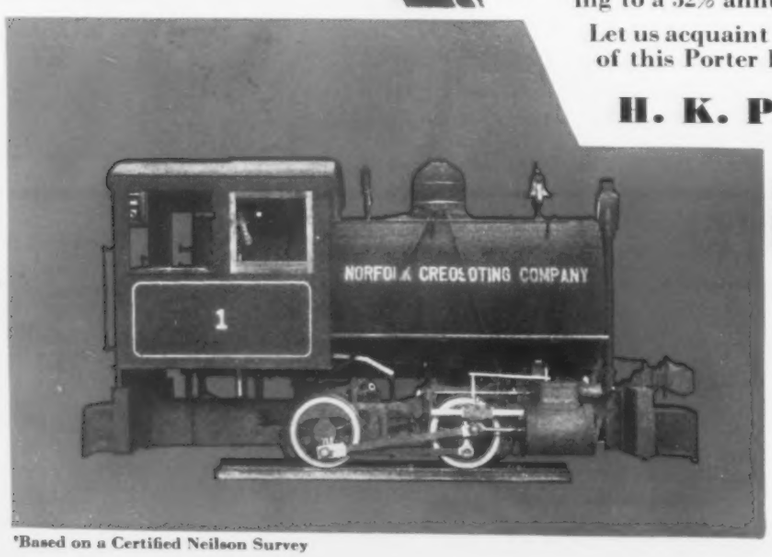
PORTER "better built" locomotives

PORTER FIRELESS LOCOMOTIVES

Only a Porter Fireless Locomotive can claim the distinction of operating at such a remarkably low figure—a figure based on its certified performance record in the Weirton Steel Company Plant.*

Compared with the daily operating cost of a standard steam locomotive, this company found that using the Porter Fireless Locomotive resulted in a net saving of $24.14 daily or $6035.00 per year—amounting to a 52% annual return on the investment.

Let us acquaint you with the wonderful advantages of this Porter built locomotive.



H. K. PORTER COMPANY

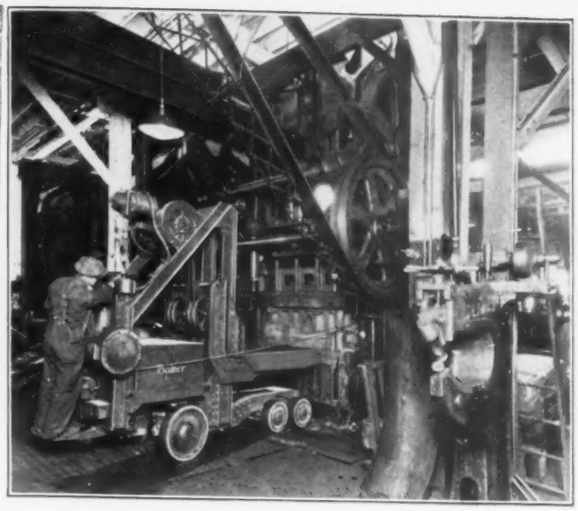
PITTSBURGH, PA.

Established 1865

N.Y. Office: 44 Whitehall St.

Chicago Office: Engineering Bldg., Wells St. & Wacker Dr.

*Based on a Certified Neilson Survey



THIS BAKER SAVES MACHINE HOURS AS WELL AS MAN HOURS

"Dies that took approximately seven hours of machine time to change under the old system (monorail) are now being changed in about 1-1/2 hours with your truck."

A pure saving, made possible by the BAKER TRUCK, of $66 every time a die is changed—based on an idle time loss of $120 a day in labor and profits.

That's what Robert R. McMath, President of Motors Metal Manufacturing Company, says about his Baker Hy-Lift Truck, which is a standard 12-ton Baker fitted with a winch. This Baker picks up dies (some of them weighing 22 tons) out of storage, transports them to the machine, and carefully puts them in place—then later reverses the process when the press run is completed. It reduces idle machine hours to a minimum and so increases production.

The Baker does its job in 1/4th the time required by a monorail and in about 1/15th the time required by man-power. The saving in man-power alone paid for the machine in a few months—the saving in machine hours was pure profit from the moment the Baker started work.

As Mr. McMath says in the letter quoted above, "anybody needing a truck of this capacity would find that it would save him a great many machine hours and man hours every month."



THE BAKER INDUSTRIAL TRUCK DIVISION

***of* THE BAKER-RAULANG CO., Cleveland**

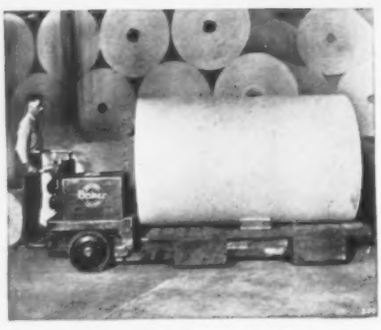
Savings Like These
Are Every-Day Savings for Bakers



[Above]
Two Baker Trucks are doing the work of eight men in the plant of the J. T. Baker Chemical Company—a labor saving of over $12,000 a year. And in addition, although the work is exceptionally hard, the maintenance costs have been negligible.



[Above]
At this southern railroad terminal, 15 Bakers have cut the cost-per-ton of handling bulk material into cars approximately 60% below hand truck costs. Larger loads and elimination of congestion make this great saving possible.



[Above]
Twelve men were formerly required to move these 3-ton paper rolls, that one Baker and one man now move with ease —a saving of eleven men on the material handling payroll.



At the works of a large electric company, 18,000,000 pounds of lead are reclaimed every month—and practically every pound of it is handled by one Baker Lift Truck. This Baker is saving approximately $12 every working day—a return of 100% on the investment every few months.

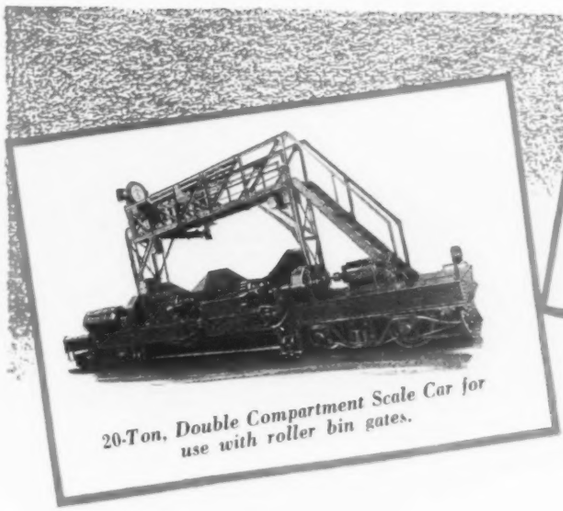


Twenty men used to be required to change the Philadelphia arena from an ice rink to a boxing ring and back again. Now one Baker and three men do the job in less time. By saving $50 a day this Baker truck has been earning 100% on the original investment every two months.

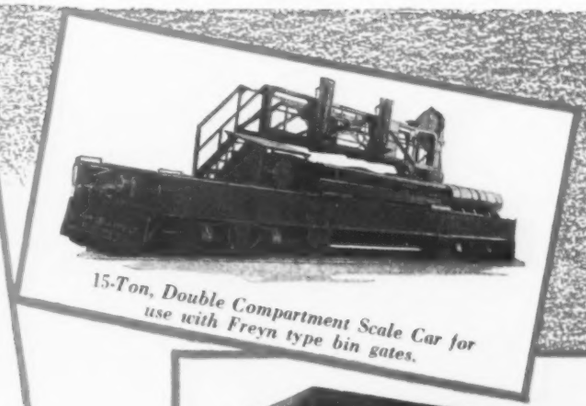
Only a few of the many kinds of jobs Bakers will do. But wherever you find a Baker, no matter what kind of work it is doing, you will find it paying for itself in a few months, in labor and time savings and increased production through faster handling. We'll gladly prove this —and tell you about other instances, equally interesting, where Bakers are making savings as high as $100,000 a year.

Baker Industrial Truck Division of
THE BAKER-RAULANG COMPANY, CLEVELAND

For Lower Haulage Costs



20-Ton, Double Compartment Scale Car for use with roller bin gates.



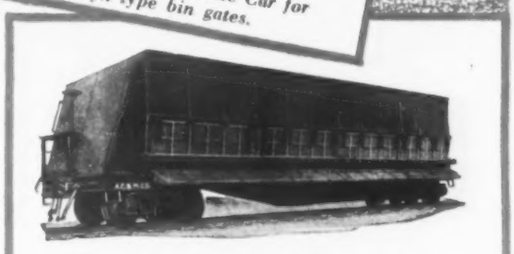
15-Ton, Double Compartment Scale Car for use with Freyn type bin gates.

ATLAS

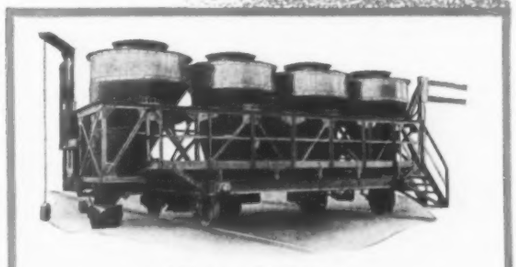
Electrically Operated Industrial Cars
Scale Cars and Weighing Cars of all kinds
Ore Transfer Cars—Blast Furnace Charging Cars
All Kinds of Special Industrial Cars
Locomotives—Storage Battery and Electric

COKE OVEN MACHINERY

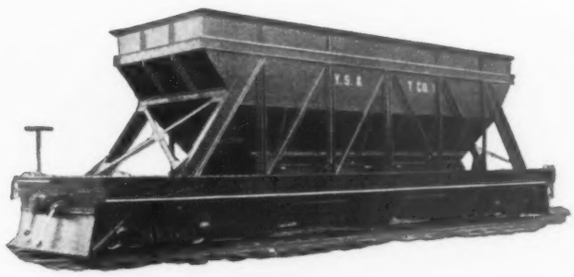
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Coke Quenching Cars, Quencher Locomotives.
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Patented Indicating and Recording Mechanism for Weighing Scales.



Coke Quencher provided with or without motor drive.

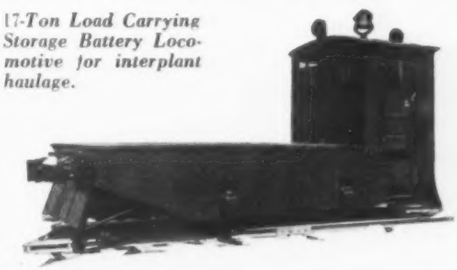


4-Hopper Coal Larry



40-Ton Capacity, Center Bottom Dump Transfer Car.

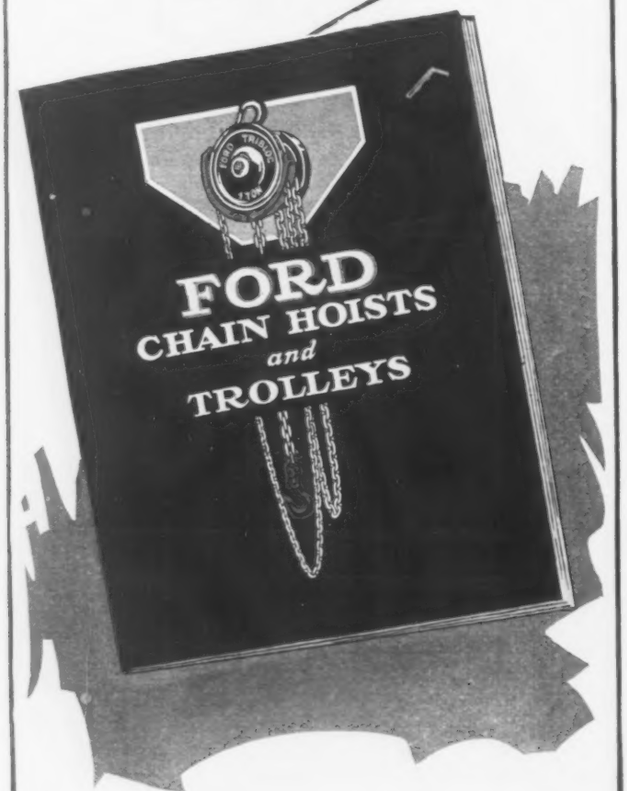
17-Ton Load Carrying Storage Battery Locomotive for interplant haulage.



THE ATLAS CAR & MFG. CO.

ENGINEERS CLEVELAND, OHIO MANUFACTURERS

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A New 1930 Catalog

Containing up-to-date reference and data on the entire line of Ford Chain Hoists and Trolleys . . . Triblocs from ¼ to 40 tons, and a complete line of trolleys, either self-aligning or Hyatt Roller Bearing.

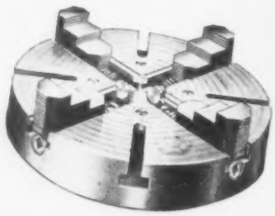
Ford Chain Block Co.,
PHILADELPHIA, PA.

Please send me FREE copy of your new 1930 Catalog.

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*ADDRESS*_____

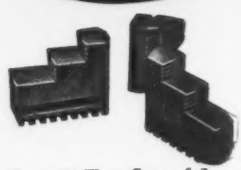
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High Production





No. 264 Independent Chuck
Steel body, three times as strong as iron, extra heavy jaws, operating screws of chrome nickel steel. Sizes 6 to 42 inches.

Complete line of Iron and Steel, Universal Independent, Geared Scroll, Scroll Combination, Planer, Boring Mill and Drill Chucks that will meet all requirements.

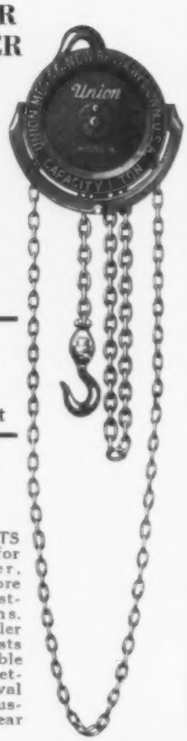


No. 153 Two Sets of Jaws
Union scroll chuck, one piece shell, can be furnished with all steel shell, hardened scroll and pinions. Sizes: 2½ to 30 inches.

Union Roller Bearing Hoists

STRONGER and FASTER

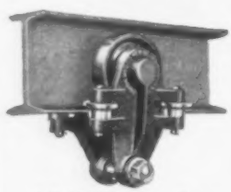




The Only Hoist With Reversible Load Sprocket

½ to 20 Ton Capacities

UNION HOISTS are designed for safer, easier, faster and more economical hoisting operations. UNION Roller Bearing Hoists with a reversible sprocket are meeting wide approval in modern industries. One year guarantee.



UNION Trolleys
Two and four wheel for large and small I-Beams.

Write for UNION Chuck and Hoist Catalog.

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New Britain, Conn.

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Locomotive Cranes, Gantry Cranes, Flexible-Tread Cranes, Shovels, Draglines and Ditchers, Truck Cranes, Road-Wheel Cranes, Clamshell & Orange-Peel Buckets

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For Lifting Boiler Plate

Easily attached and removed. Cannot slip. Prevents accidents and saves time and labor.

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TELEPHONE BARCLAY 2133 **N.B.PAYNE&CO.** 25 CHURCH ST. NEW YORK

OVERHEAD ELECTRIC AND HAND CRANES AND HOISTS
Our specialty for many years.
See pages 462-469

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Railway and Utility Supplies

CASTINGS—Grey Iron, Brass and Aluminum, PATTERNS FORGINGS, SPECIAL MACHINERY, MACHINE & SHEET METAL WORK, ARMATURE AND FIELD COILS

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Equipped with hook, bucket, clamshell or magnet, they can easily handle any kind of loose materials. Easily maneuvered on their Corduroy traction—no tracks required.

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Is complete from two to sixty ton sizes. Write for catalog and performance bulletins. Time is the test. It's the saving in operation cost that counts.

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CAPACITIES ¼ to 10 TONS
DETROIT HOIST & MACHINE CO.

LEWIS-SHEPARD COMPANY
122 WALNUT STREET, WATERTOWN STATION, BOSTON, MASS.



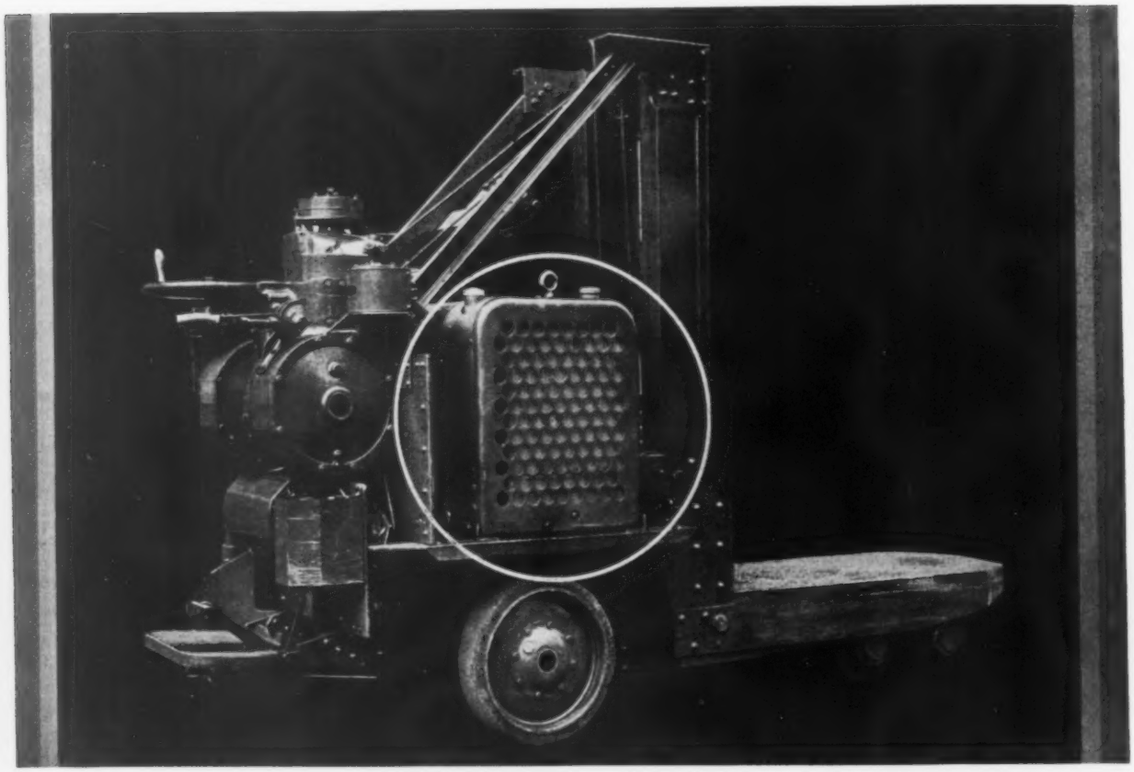
HANNA AIR HOISTS
Price is a small fraction of any other type of Power Hoist
HANNA ENGINEERING WORKS
1761 ELSTON AVE., CHICAGO, ILL.



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The Chase Fdy. & Mfg. Co.
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EASTON CARS
FOR EVERY INDUSTRIAL PURPOSE
EASTON CAR & CONSTRUCTION CO. EASTON, PA.

10 HOURS—*plus*
from your trucks—



ELECTRIC Industrial Trucks need no longer be limited to a ten-hour day nor their users be required to invest in extra batteries for overtime operation.

Nor need any of the flexibility and extreme ease of operation of the electric be sacrificed to obtain continuous service at peak performance.

READY-POWER generates electric truck power from gasoline exactly as required, not before. The "charging" of READY-POWER consists of replenishing gasoline, oil and water—a matter of minutes, not hours.

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Your present electric trucks can be readily equipped with READY-POWER and new trucks which you install will be READY-POWER equipped by the truck manufacturer on your order.

Hundreds of successful installations among the leading manufacturing organizations and railroads in America and abroad are daily fulfilling their promise. The Ready-Power Co., 3820 Grand River Ave., Detroit, Michigan.

Write us mentioning the make and type of truck you operate for quotations on the proper size and type of READY-POWER for your equipment or for further information.

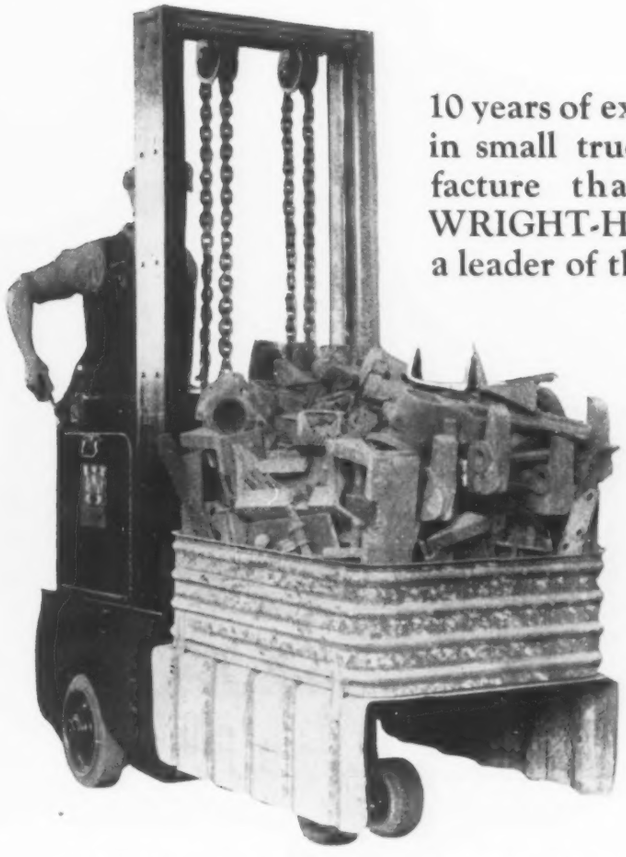
READY-POWER
GASOLINE ELECTRIC
for ELECTRIC INDUSTRIAL TRUCKS

Insist on the RIGHT TRUCK

What's in back of "Wright" Trucks?

Insist on the RIGHT TRUCK

Western Electric Co.
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10 years of experience in small truck manufacture that makes WRIGHT-HIBBARD a leader of the field!

"Wright" advantages

Short turning radius of 5'-4" (the shortest radius of any truck on the market). . . . 3½" clearance between floor and frame . . . One motor, instead of two, drives the truck and lifts the platform . . . Gears hardened and ground to size . . . 3 point front axle suspension. . . . S. A. E. Standards throughout . . . Parts interchangeable throughout . . . Battery in spring container in battery box. Easily operated in small congested spaces. In fact, this WRIGHT-TRUCK may be called a general utility truck.

Although there have been a number of attempts made to build a small electric truck that would satisfactorily replace hand trucks, none has been as sucessful as the WRIGHT-HIBBARD.

When WRIGHT-HIBBARD proposed to build such a labor-saving truck the skeptics said, "It can't be done," but by constant study of problems involved, and continued belief in our ability to relieve production problems, we built a truck that has been accepted by leading manufacturers as the finest truck both for large and small plants.

The list of customers shown in brackets on this page, many of whom have reordered several times, proves the idea was sound and that an efficient, powerful truck, of size to permit use in restricted spaces, is a money-maker.

By constantly improving models, based on a long manufacturing experience and close study of customers' needs—WRIGHT-HIBBARD, the *experienced builders* of electric trucks—built to run in aisles—around corners—anywhere a hand truck will go—keeps as far ahead of the field as ever.

Insist on the RIGHT TRUCK

Wright-Hibbard Industrial Electric Truck Co., Inc.

PHELPS, NEW YORK

Insist on the RIGHT TRUCK

TIMKEN Tapered ROLLER BEARINGS
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CARPENTER
EUCLID CONTROLLERS
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BALL BEARINGS
MADE OF THE BEST SOLD FOR THE LEAST
THE CRESCENT Star
A POWER TRUCK FOR USE WITH YOUR HAND TRUCK SKIDS
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F.O.B. LEBANON – BATTERIES EXTRA
"IT PAYS TO CRESCENTIZE"
CRESCENT TRUCK CO. Lebanon, Pa.
16 Years of Experience Building All Types of Electric Industrial Trucks, Trailers and Tractors

THE LAST OBSTACLE TO CASTER PERFORMANCE IS ELIMINATED

Caster Progress

FRICTION
Friction eliminated by Saginaw Ball and Roller Bearings with Saginaw lubrication.

BREAKAGE
Breakage eliminated by the Saginaw pressed steel design and construction.

RUST
Rust eliminated by the Parkerizing of all parts of Saginaw Casters.



RUST, the last obstacle to the efficiency of all steel caster performance, has now been definitely eliminated.

Effective at once—Saginaw Casters will be completely Parkerized as a permanent protection against the ravages of corrosion, which annually cost the laundries, creameries, packing houses, tanneries, and other process industries thousands of dollars for caster replacement.

Again, Saginaw leads in pioneering a most worth-while improvement.

Write for complete caster specifications.

SAGINAW STAMPING & TOOL CO., SAGINAW, MICH.

SAGINAW CASTERS

"AUTOMATIC"

maintains
An Engineering Service for Men Interested In *Making* Money by *Saving* Money



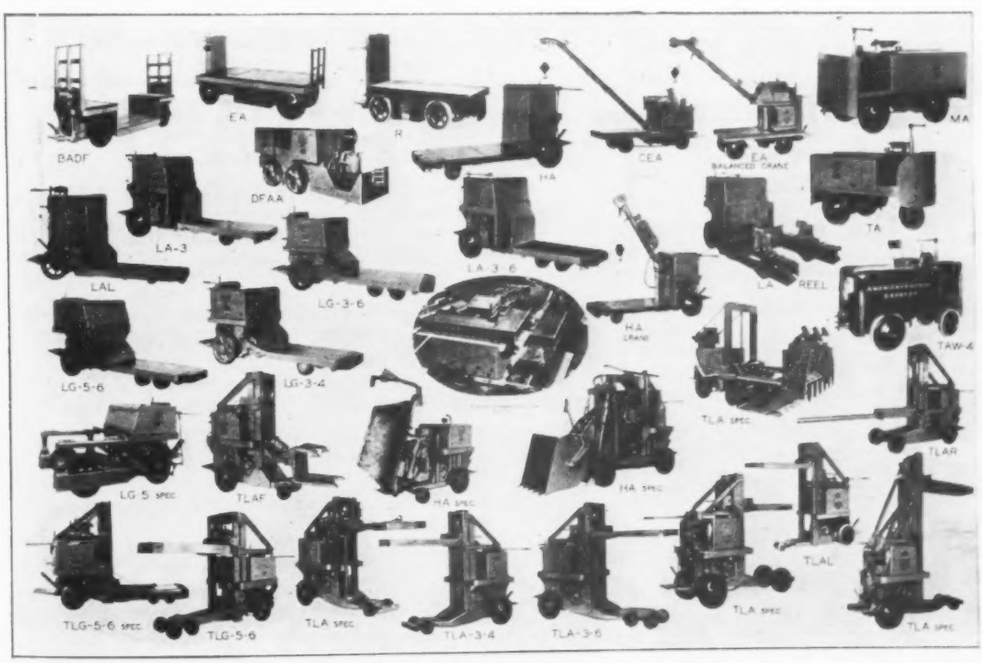
BELIEVING that the selection of the *right type* of material handling truck is as important as choosing the best make, "Automatic" offers the services of an experienced group of engineers without charge. Their experience qualifies them to study your material handling problems and recommend a working plan and layout with estimated operating economies in advance.

The experience of plant executives has repeatedly shown that in addition to reducing their costs, "Automatic" trucks usually pay for themselves within six to eight months.

Any manufacturer or business concern interested in making money by saving money through greater economies in handling materials is invited to take advantage of this "Automatic" engineering service.

It costs nothing, and you assume no obligation, when you have an "Automatic" Transportation Engineer make a survey of your material handling problems at your plant. Address Engineering Service Department.

AUTOMATIC
TRANSPORTATION CO., Inc
2933 Main Street, Buffalo, N. Y.



The Automatic Line includes

Load Carrying
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Die Handling
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Ram Trucks
Dump Hoppers
Locomotives
Tractors, etc.

There is an "Automatic" Truck to solve every Intra-Plant Transportation and material handling problem



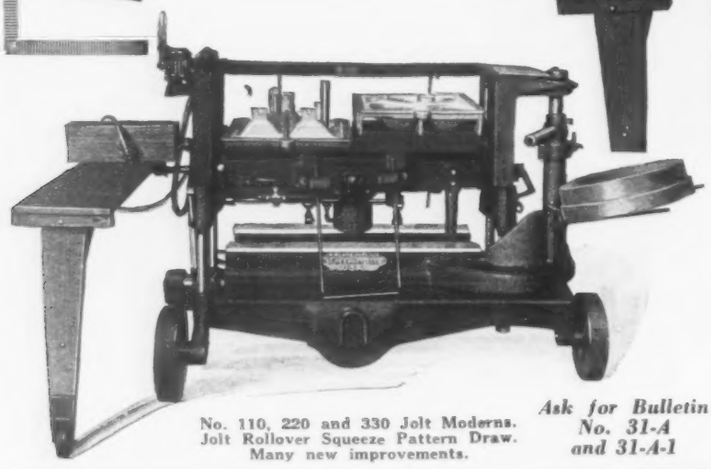
Arcade Flasks and Jackets Last Longer



Steel Jackets
No. 10 Gauge
WELL BRACED

Ask for Bulletin 31-1

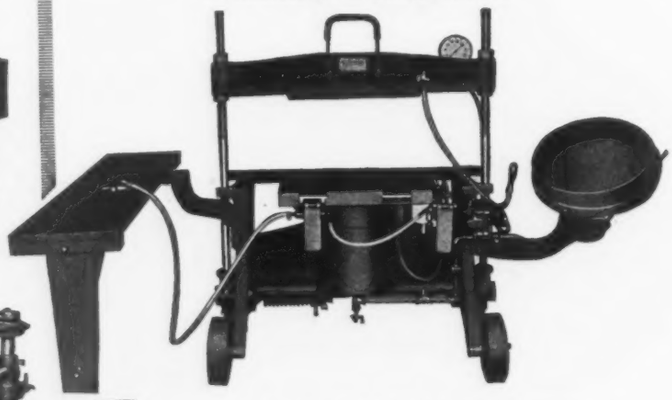
Cherry Flask
MILLED PINS
AND EARS



No. 110, 220 and 330 Jolt Moderns. Jolt Rollover Squeeze Pattern Draw. Many new improvements.

Ask for Bulletin No. 31-A and 31-A-1

ARCADE
Molding Machinery and Foundry Equipment



No. 81 and No. 91 Jolt Squeezer

Distance between uprights	32″ and 36″
Diameter Jolt Cylinder	3″ and 4″
Diameter Squeeze Cylinder	8½″ and 10″

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ARCADE MANUFACTURING COMPANY
FREEPORT - - - - - - ILLINOIS, U. S. A.

HERMAN
Jarr Independent Rollover and Pattern Drawing
MOLDING MACHINES

Send us your inquiry and our Service Department will gladly advise with you on your requirements.

Herman Pneumatic Machine Co. General Offices Union Bank Bldg., Pittsburgh, Pa.

SHOT GRIT
QUALITY ABRASIVES
For Every Blast Purpose
STEELBLAST ABRASIVES CO.
Cleveland, Ohio
Write for Samples
STEELBLAST



Molding Machines
for production and jobbing castings
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Sandblast · Tumbling Mills · Complete Installations with Dust Arresters
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PARTICULARLY ADAPTED FOR SAND BLAST CORE SAND and FURNACE BOTTOM
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For every industrial requirement
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SELECT SILICA SANDS

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STEEL MOLDING
CORES
SAND BLASTING
FURNACE BOTTOMS
HOT TOPS
ETC.

Start your castings right with Industrial steel molding and core sands, and finish them right with Industrial sandblast sands.



INDUSTRIAL SILICA CORPORATION
YOUNGSTOWN OHIO

Here Are the Savings!

IN LABOR—$701.80 is saved daily in labor alone—$2.42 per ton on an 8 hour daily production of 290 tons.

IN FLOOR SPACE—More than $20,000.00 yearly is the saving in floor space. Molding Unit No. 1 producing 500 six and eight cylinder motor blocks daily in a floor area of 5600 square feet would need 9600 square feet at $5.00 per square foot under other operating conditions.

IN OVERWEIGHT—Accurate ramming, due to the perfect control obtained with Sandslingers, has effected a saving in weight of 1½ to 4 pounds per casting.

IN NAILS AND GAGGERS — The even, controlled density of ramming entirely eliminates the need for nails and gaggers, and the cost of reclaiming them. No nails or gaggers are used.

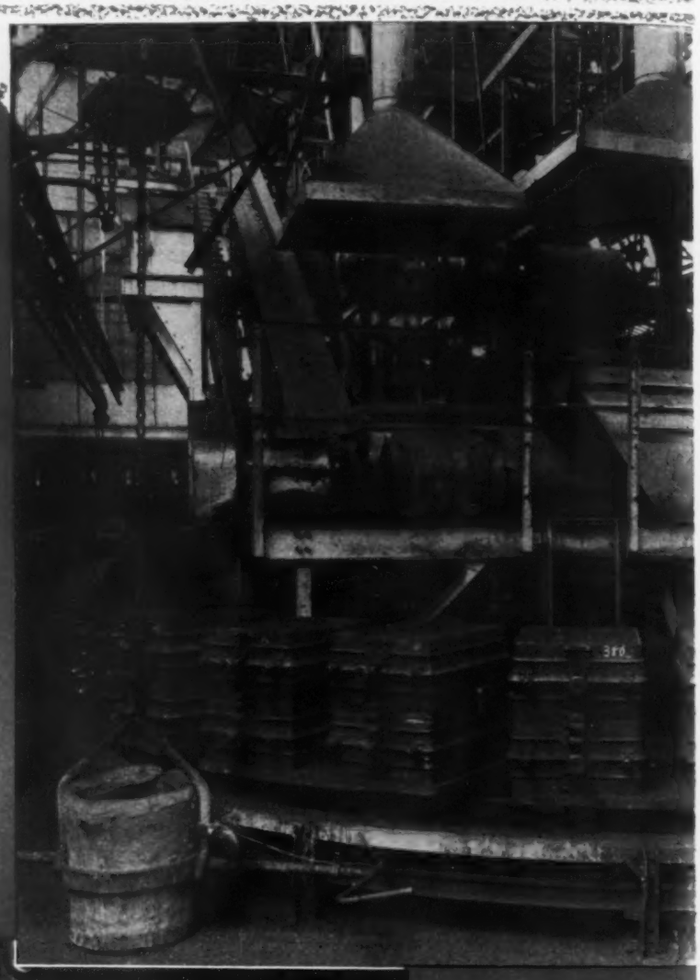
IN NUMBER OF FLASKS NEEDED—Thousands of dollars have been saved in reducing the number of flasks required. One job formerly requiring 450 cast steel flasks costing $80.00 each now uses only 110 flasks, a saving of $27,200.00.

IN PATTERN DEPRECIATION—Because shock, jolts and severe bumps are not possible with Sandslinger ramming, pattern life is many times greater than it would be were other molding methods employed.

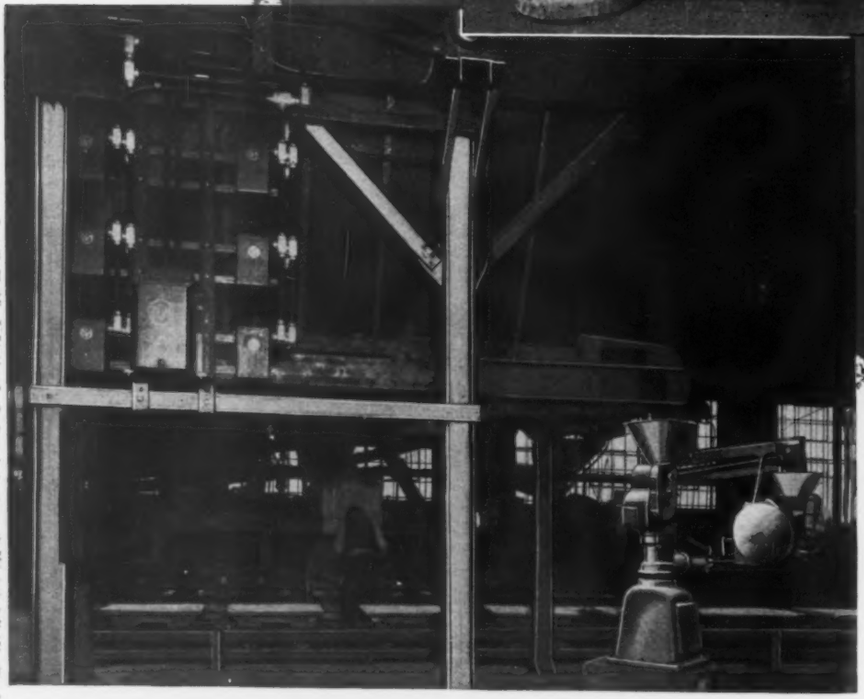
IN PRODUCTION INCREASE—Production has been increased more than 300 per cent per hour from 100 tons per 10 hour day to 290 tons per 8 hour day.

SUMMARY—Production has been more than tripled in the 2 hour shorter working day. Physical labor has been reduced to the operation of efficient machines within the same floor space and with a labor cost of $2.42 per ton lower.

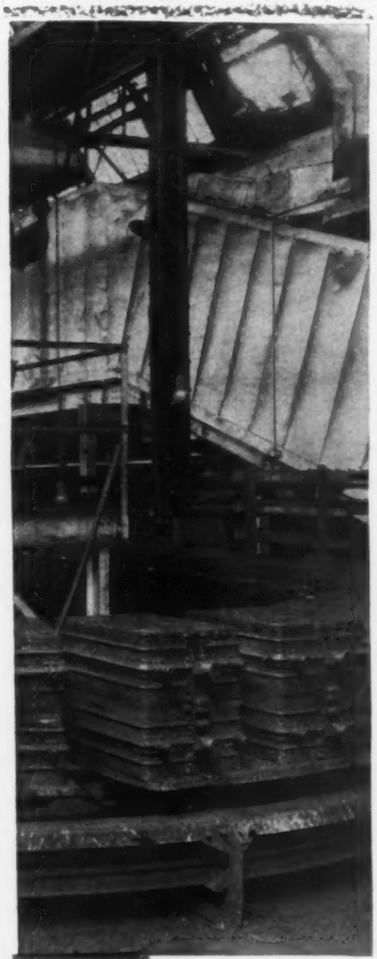
Maximum efficiency obtains and scrap, including machine shop spoilage, has been reduced to the very minimum.



A view from the sand conditioning end of one of the complete molding units at Nash Motors. Note excellence of arrangement, space economy and the general appearance of efficiency.



The ramming station of one of the highly efficient BANDP Molding Systems at Nash Motors, Kenosha, Wisconsin.



ENORMOUS SAVINGS EFFECTED

By Mechanical Ramming and Handling at NASH MOTORS COMPANY, Kenosha, Wisconsin

SEVEN Stationary Type *Sandslingers* with Turntables served by 2 complete BANDP Molding Systems, including sand storage, pug mills, vibrating screens, magnetic separators, mold, flask and sand conveyors, etc., and three conveying systems of other makes are producing 290 tons of 6 and 8 cylinder automobile blocks, fly wheels, cylinder heads, manifold and transmission cases daily.

The unusual efficiency of this complete *Sandslinger* equipped shop is presented in the following production facts on 6 Nash molding units:

Large Molding Unit No. 1—Here 31* men and 2 Stationary Type *Sandslingers* and Turntables are making 500 six and eight cylinder motor blocks in 8 hours, using 28″ x 48″—13″ cope and drag—and 30″ x 56″—15″ cope and drag.

Small Molding Unit No. 1—11* men and a Stationary Type *Sandslinger* produce 900 fly wheel molds daily, 2 in a flask 40″ x 20″—6″ cope and drag.

Molding Unit No. 2—A Stationary Type *Sandslinger* and 20* men make 450 cylinder blocks daily for the Nash Standard Six, using 27″ x 16″ flasks—11″ cope and drag.

Molding Unit No. 3—14* men and a Stationary Type *Sandslinger* produce 560 Nash 6 and 8 cylinder heads with 20″ x 52″ flasks—10″ drag (no cope used).

Molding Unit No. 4—630 six and eight cylinder Nash Transmission Cases are the daily production on this unit with 14* men and a Stationary Type *Sandslinger*.

Molding Unit No. 5—A Stationary Type *Sandslinger* and 14* men are producing 630 transmission cases using 27″ x 32″ x 36″ flasks, or when molding on manifolds, 7* men produce 250 per 8 hour day, using 18″ x 33″ x 10″ flasks.

*In all the units mentioned the number of men designated includes supervision, core assemblers and core setters, molders, clampers, pourers, runner box makers and shakeout men.

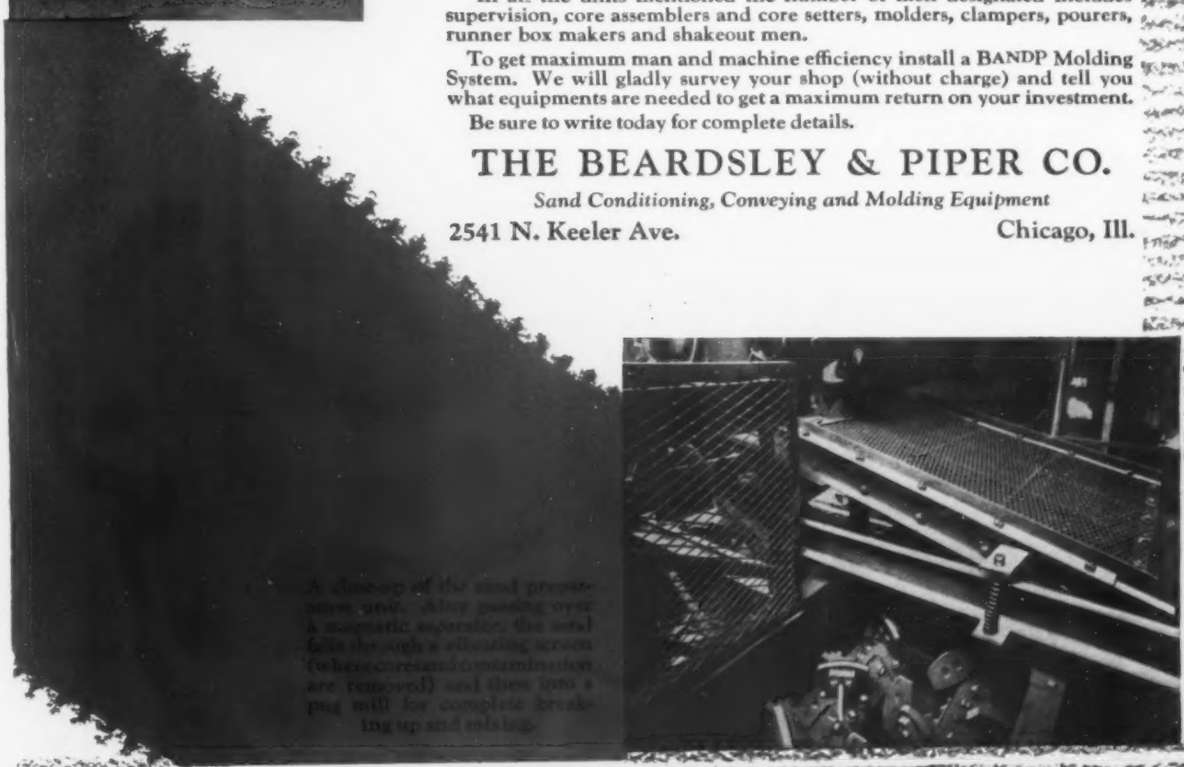
To get maximum man and machine efficiency install a BANDP Molding System. We will gladly survey your shop (without charge) and tell you what equipments are needed to get a maximum return on your investment.

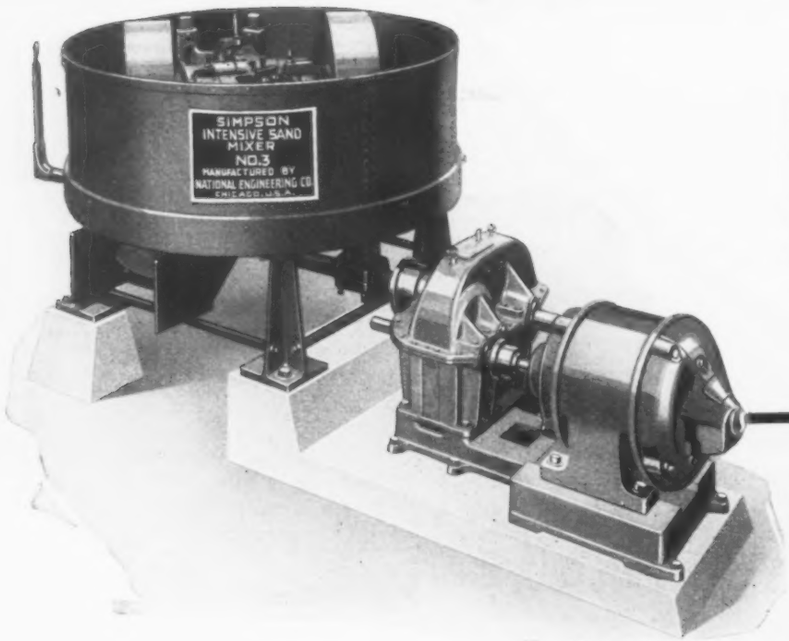
Be sure to write today for complete details.

THE BEARDSLEY & PIPER CO.

Sand Conditioning, Conveying and Molding Equipment

2541 N. Keeler Ave. Chicago, Ill.





"THE PRODUCT OF A PRACTICAL FOUNDRYMAN"

SIMPSON INTENSIVE SAND MIXERS

ARE HIGHLY RECOMMENDED

by foundrymen all over the country for the preparation of core, facing and backing sand, also for preparing sand in continuous sand handling systems. SIMPSON MIXERS are made in five sizes and are universally used in gray iron, steel, malleable, brass and aluminum foundries.

You can save new sand, binder and labor as well as improve your castings and reduce cleaning costs by properly preparing your sand mixtures in a Simpson Intensive Sand Mixer.

It will pay you to investigate the Simpson Mixer for your foundry.

Simpson Mixers are also being used for the preparation of furnace linings, high temperature cements, crucible stock, terra cotta stock and other materials where an intensive mixing action is essential to the best results.

WE SPECIALIZE

in the

DESIGN

and

MANUFACTURE

of

FOUNDRY
SAND PREPARING
SAND HANDLING

and

MOLD HANDLING
EQUIPMENT

Write for Details

NATIONAL ENGINEERING COMPANY

549 W. WASHINGTON BLVD. CHICAGO, ILL.

All Three Agree

Manufacturers everywhere are discovering new ways in which to cut costs and speed production by using Globe Barrels. The Globe Tumbling Book points the way. Write for your copy.



IN hundreds of plants these three men are unanimous in their agreement that Globe Tumbling Equipment offers "a most for your money" value.

The President approves the purchase of Globe Barrels because they have proved their economy as labor savers, thereby increasing profits.

The Superintendent realizes that Globe Tumbling Barrels have abolished hand finishing methods, thus speeding production.

The operator praises Globe Tumbling Barrels because they require a minimum of attention and help him to do more and better work.

Globe engineers have developed a complete line of barrels to meet all tumbling requirements including tilting and horizontal models, also special types for burnishing and sand rolling—each type available in sizes suitable for the class of work to be tumbled.

Globe Barrels may be equipped for individual motor drive, an advantage which cuts power costs and permits installation in any location, thus eliminating crowding and trucking expense.

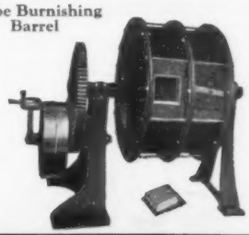
If you have a finishing problem that runs your production cost up, it will pay to investigate Globe Tumbling Equipment.

The Globe Machine & Stamping Co.

1250 W. 76th St., Cleveland, Ohio

GOOD BARRELS FOR EVERY TUMBLING NEED SINCE 1904

Globe Burnishing Barrel



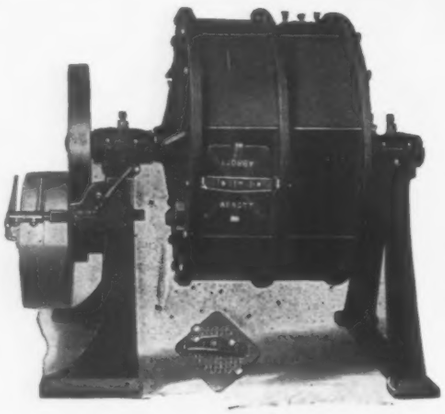


Globe Horizontal Tumbling Barrel

Globe Barrel for Sand Tumbling



ABBOTT



—1930—

BALL BURNISHING

is always up to date because it is the most economical method known, of finishing small metal stampings, forgings and castings.

A wide range of equipment sizes are available and the low cost of this method makes it adaptable to the finishing of both small and large production lots.

Our Experimental Department will gladly put through samples to show exactly what Ball Burnishing will do. Why not investigate?

THE ABBOTT BALL COMPANY

"Originators of Commercial Ball Burnishing"

1047 NEW BRITAIN AVENUE **HARTFORD, CONN.**

There Are Reasons Why



Threaded Connections
Rack and Pinion
Operating Mechanism

. . . the Metallurgical, Chemical, Ceramic and other industries use Rockwell Air-Tight Blast Gates.

Chief among them is the fact it is an air-tight gate having a slide that "stays put."

Then, too, it affords the full area of the pipe line, and it is positive and quick acting.

Here is the ideal unit for controlling the flow of low pressure air.

Write for Bulletin 282-Q for further information.

New York Chicago
Detroit Montreal

314

IDEAL
TRADE MARK REG. U.S. PAT. OFF.

Dipping, Drying, Tumbling and Burnishing Machines cut production costs

See page advertisement in Jan. 9 issue.

N. RANSOHOFF, INCORPORATED
West 71st St. at Millcreek Carthage, Cincinnati, Ohio



RECLAIM every bit of valuable iron from foundry refuse *mechanically* with a High Duty Magnetic Separator. Three separations—iron, sand and slag—without hand labor. Saves 75c. to $1.20 on every ton refuse; pays for itself. Write for bulletin.

MAGNETIC MFG. CO.
225-24th Ave., Milwaukee, Wis.

STEARNS MAGNETIC SEPARATORS

Blowers
Vacuum Pumps
Liquid Pumps

ROOTS

Meters
Gas Pumps
Valves, Gates

Originators of the Two-Impeller Principle

THE P. H. & F. M. ROOTS CO.

CHICAGO Peoples Gas Bldg. Connersville, Indiana *Established 1859* NEW YORK 120 Liberty St.

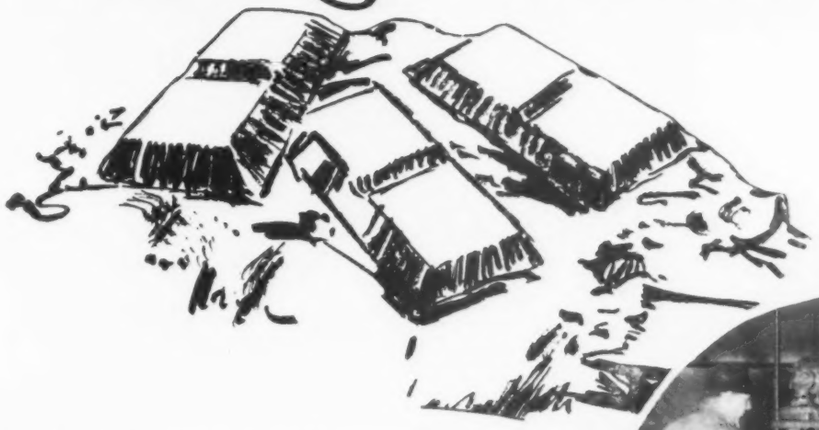
Crucibles

ROSS-TACONY CRUCIBLE CO.
TACONY
PHILADELPHIA, PA.

Stopper Heads

ESTABLISHED 1871

These pigs didn't go to market!



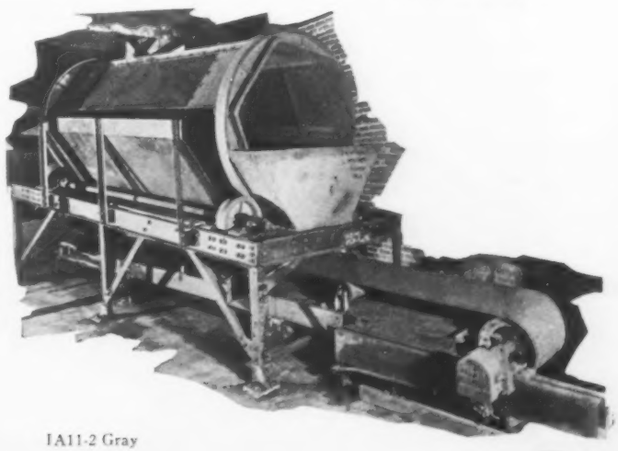
Type M Separator used to separate iron from brass and other non-magnetic borings.



THREE and a half pigs out of every hundred didn't go to market as finished castings for the Jewell Steel & Malleable Co., San Francisco; they stayed at home, on the dump. 3½% of the total daily charge of pig iron lost—until a Dings Magnetic Separator was installed and reclaimed the risers, scabs, etc., from the shakeout.

How much of your daily charge of pig iron goes on the dump, how many days' production lost a year, how much profits thrown away? Dings engineers will tell you. Send them a sample of your dump pile. They'll analyze it for a small charge and let you know the value of the iron that a Dings can profitably reclaim. Find out the profits you can take from the dump.

Dings Magnetic Pulley with screens used to extract iron from Foundry waste.



Dings Magnetic Separator Co.
727 Smith Street, Milwaukee, Wis.
Established in 1899
The world's largest manufacturers of Magnetic Separators

New York City
30 Church Street

Boston
304 Rice Building

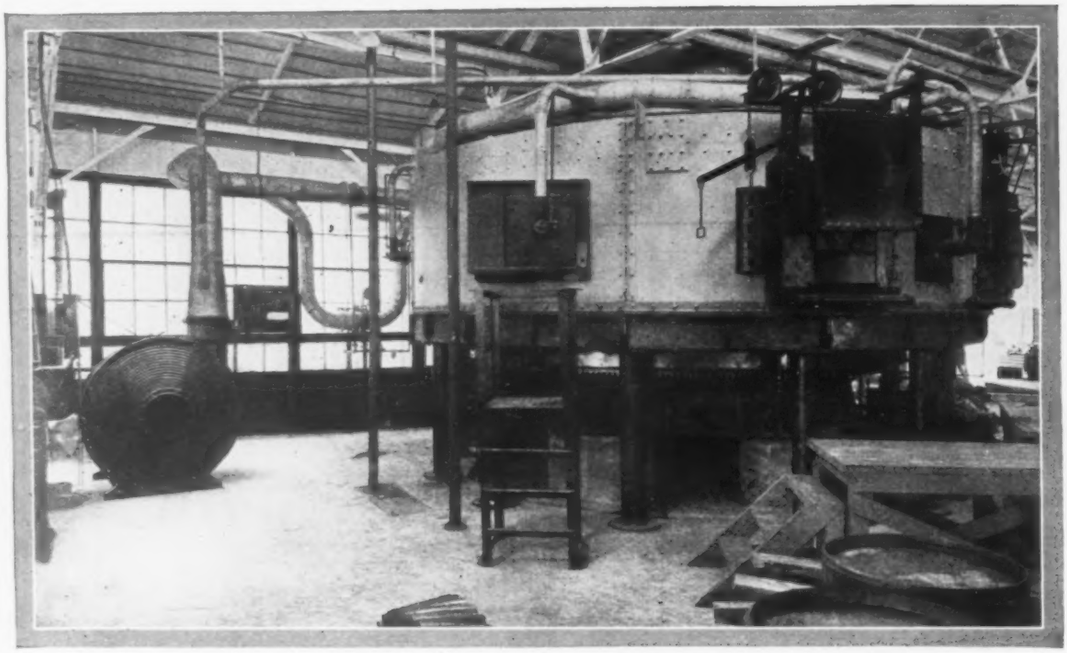
San Francisco
273 Seventh St.

Chicago
332 So. La Salle St.

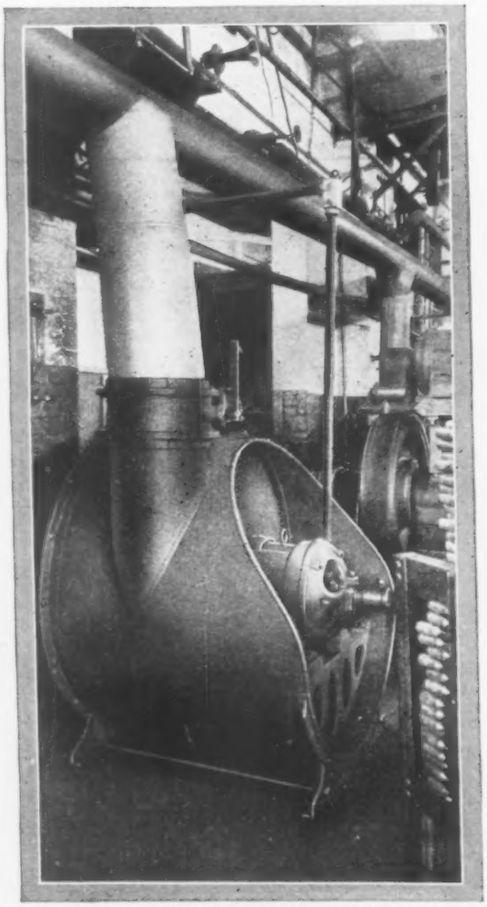
Branch Offices in Principal Cities

Dings High Intensity MAGNETIC SEPARATION

IA11-2 Gray



(Above) Spencer Cat. No. 1540, 40 H.P., 3600 c.f.m., 20 oz. Turbo-Compressor used for automatic heating of forgings at 2400 degrees F. in plant of Budd Wheel Co., Detroit, Mich.



Spencer Cat. No. 1525, 25 H.P., 2250 c.f.m., 24 oz. Turbo-Compressor in plant of Thompson Products Co., manufacturers of piston rings, Detroit, Michigan.

Where Slow Speeds Mean Low Costs

The Spencer Turbo-Compressor is a slow speed, quiet operating machine that has proven its merit by more than ten years of service in connection with oil and gas fired equipment.

It has wide clearances, extra heavy shafts and bearings, is particularly free from vibration and has many features found in no other machines and which give lower operating costs in the long run.

Ask your furnace or oven manufacturers about the equipment that is operating daily in your vicinity. They will say "Spencer for Reliability."

Bulletins on request.

THE SPENCER TURBINE CO.

HARTFORD, CONN.

3117



...THE MOST IMPORTANT WORD ON ANY ROLL REQUISITION

He is accustomed to solving Roll Problems right on the job. Following is the background of training and experience of the 6 experts comprising this staff.

Engineer No. 1—Graduate of the Academy of Mines. Freiberg, Saxony, Germany. Class of 1894. 27 years practical experience.

Engineer No. 2—Grew up in the foundry business. Specializing in Rolls. 31 years practical experience.

Engineer No. 3—Graduate Carnegie Tech. Class of 1921. 8 years practical experience.

Engineer No. 4—Graduate George Washington University. Class of 1908. 18 years practical experience.

Engineer No. 5—Graduate Yale, 1908. Post graduate of Massachusetts Institute of Technology. 19 years practical experience.

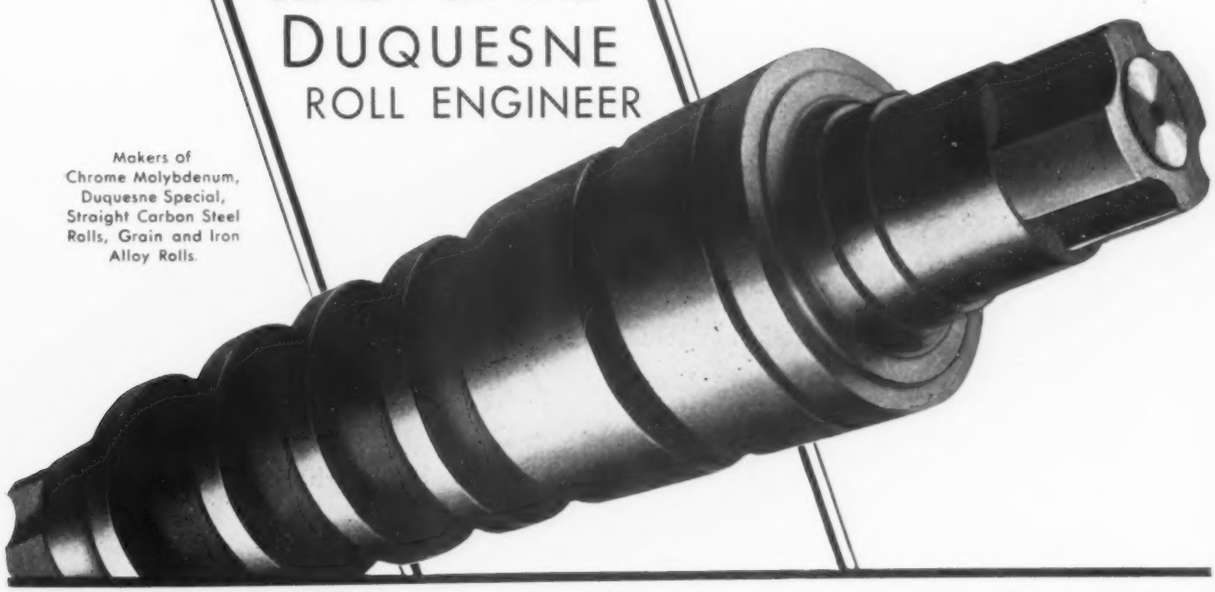
Engineer No. 6—Graduate of Lawrence Scientific School, Harvard University, 1903. 25 years practical experience.

The men responsible for production know what will produce the best results. Their opportunity to observe results qualifies them to give valuable assistance when it comes to re-orders. That is why specifications on mill requisitions are being more respected by officials in charge of purchases.

The word "Duquesne" on a requisition for rolls means that a roll of known quality and proved performance is wanted.

SEND FOR THE DUQUESNE ROLL ENGINEER

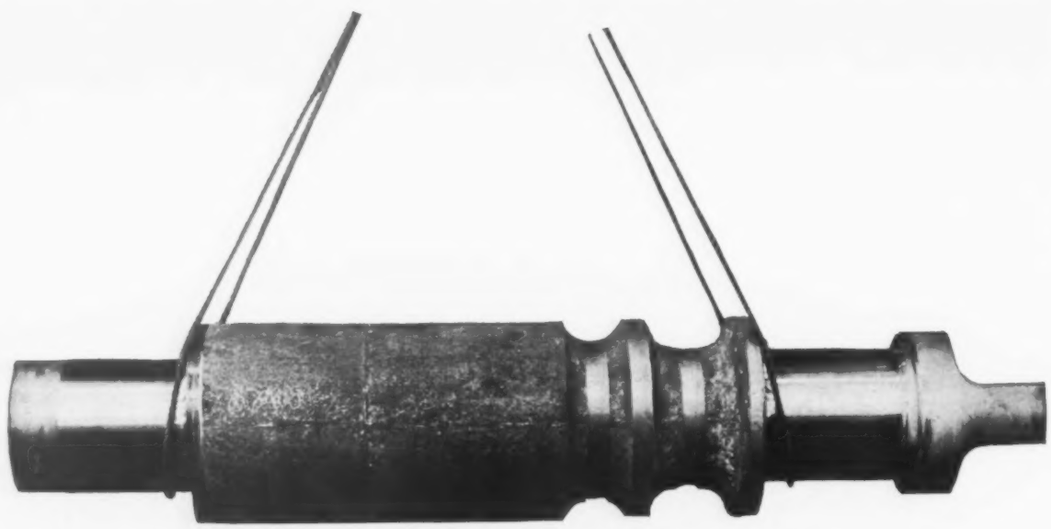
Makers of Chrome Molybdenum, Duquesne Special, Straight Carbon Steel Rolls, Grain and Iron Alloy Rolls.



DUQUESNE

DUQUESNE STEEL FOUNDRY COMPANY . . . PITTSBURGH, PA.

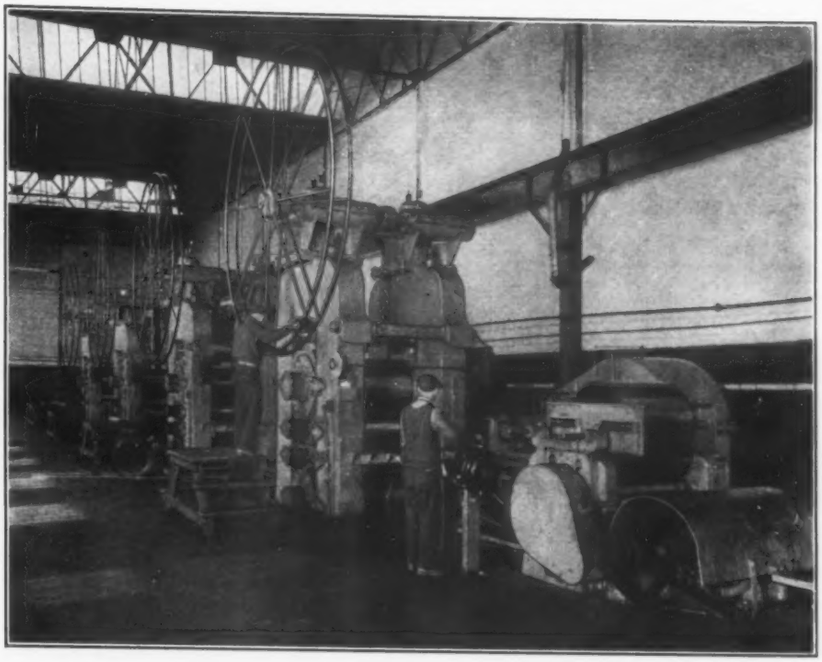
PHOENIX
Steel and Alloy Rolls



For making steel and alloy rolls we have open hearth capacity of 2000 tons finished rolls per month. Accurate treatment of castings is assured.

Any desired carbon or analysis can be furnished.

Pittsburgh Rolls Corporation
Pittsburgh Penna.



ROLLING MILL EQUIPMENT
FOR
HOT OR COLD ROLLING

BLISS Four-High Mills are built in all sizes and are roller-bearing equipped throughout.

BLISS also builds:

Mill Reels	Slitters
Shears	Coilers
Winding Reels	Leveling Machines
Recoiling Machines	Scrap Baling Machines

And Special Equipment for Special Needs

Full details on request

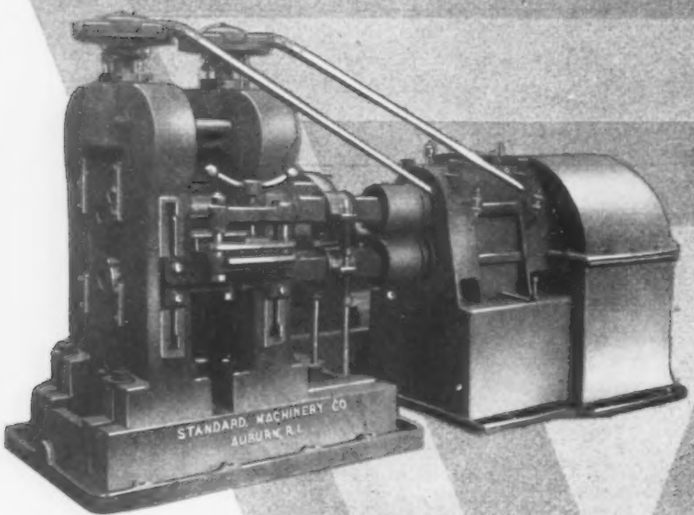
BLISS for MACHINERY

E. W. BLISS CO., BROOKLYN, N. Y., U. S. A.

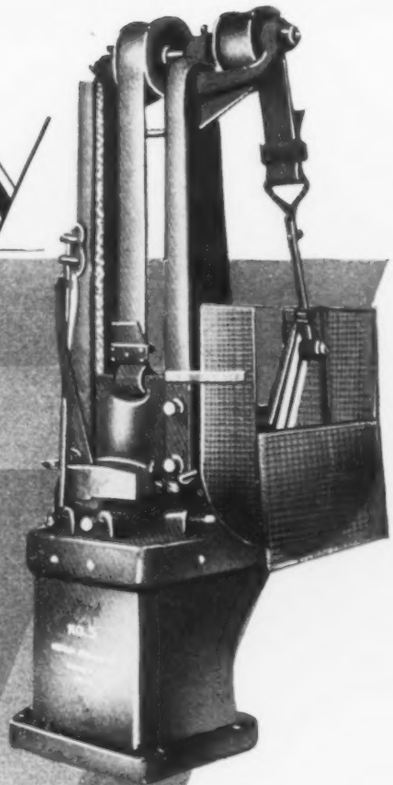
Factories: BROOKLYN, N. Y. HASTINGS, MICH. SALEM, OHIO
Sales Offices: DETROIT CLEVELAND CHICAGO ROCHESTER
PHILADELPHIA CINCINNATI NEW HAVEN BOSTON
Foreign Factories and Offices: LONDON, Eng. TURIN, Italy PARIS, France

BLISS

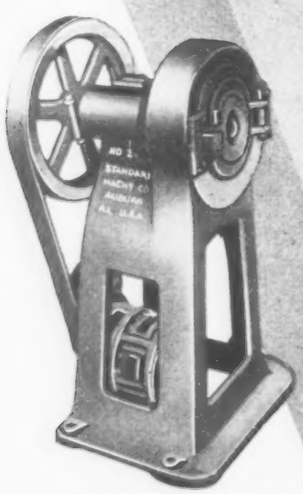
"STANDARD" MACHINERY



10" STRIP MILL
Roller Bearings
Throughout



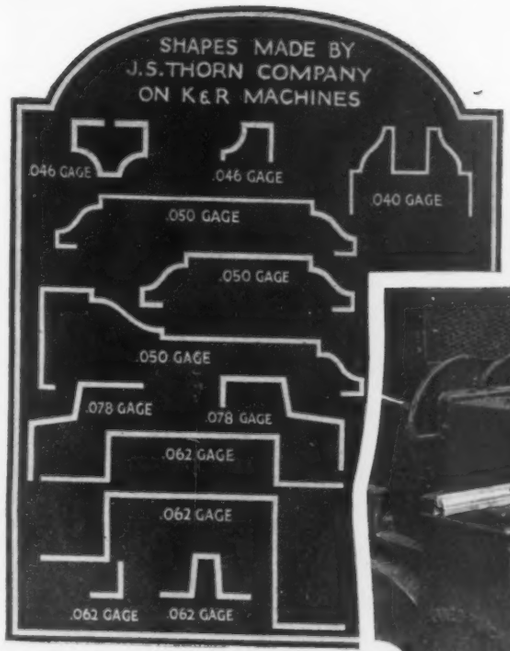
"STANDARD"
Automatic
Drop Press

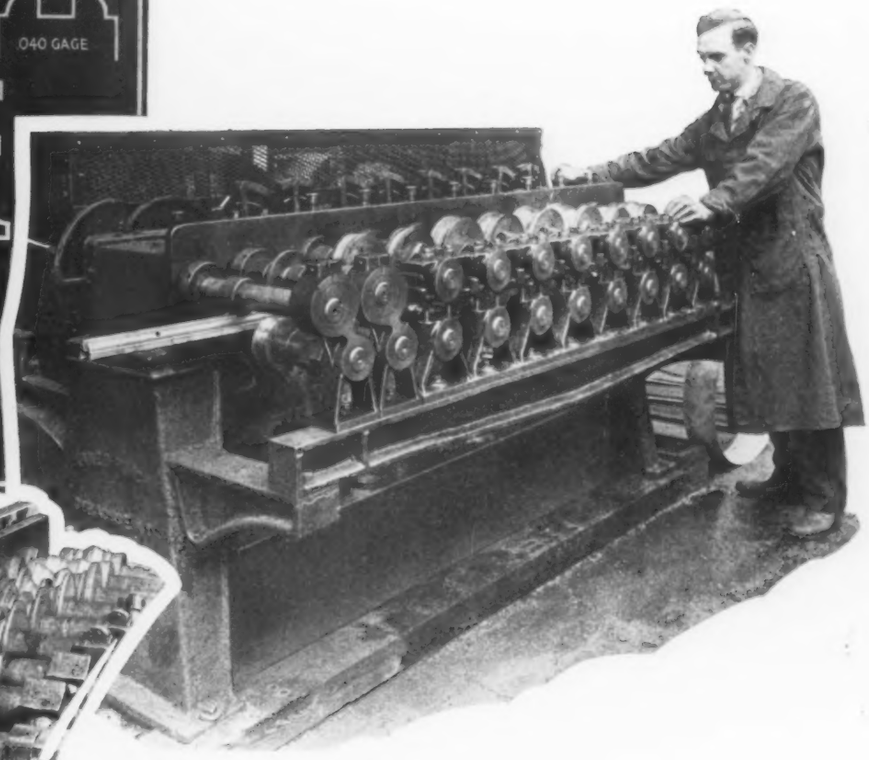


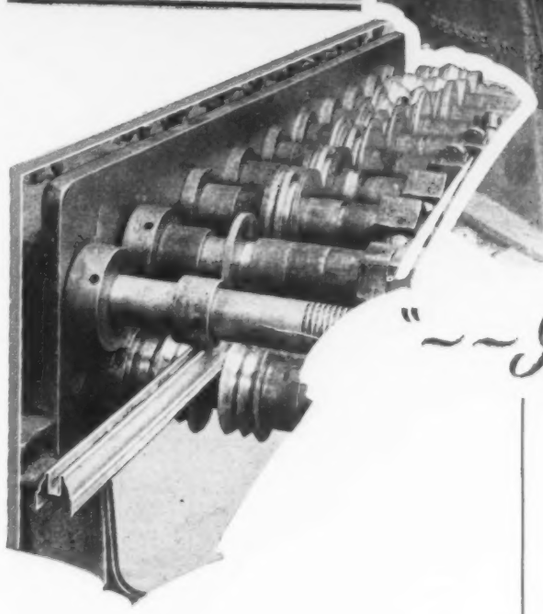
No. 2A
SWAGING
MACHINE
Capacities
0" to 4¾"

Manufacturers
OF
ROLLING MILLS
POWER PRESSES
DROP HAMMERS
DRAW BENCHES
SWAGING MACHINES
BALL AND ROLLER
BEARINGS

STANDARD MACHINERY CO.
AUBURN, RHODE ISLAND







"~~Increased Production"

In a recent letter from Mr. F. Rhoads of the J. S. Thorn Co., of Philadelphia, about their K & R equipment, he made the following comment:

"We are very enthusiastic over the quality of the work and the increased production of the various shapes we produce on the rolling machine recently furnished us.

"Your cooperation is greatly appreciated, and we would not hesitate to recommend your equipment."

K & R type machine provides a single rigid outboard roll shaft bearing support, while at the same time permitting quick interchangeability of rolls. An innumerable number of shapes may be made by additional rolls.

Kane & Roach Manufacture:

Cold Roll Forming Machines for handling Angles, Channels, U-Bars, Steel Door Casings, Steel Mouldings, Auto Tire Covers, Radio Loud Speakers, Electric Advertising Signs, Windshield Wipers, Auto Running Boards, Mouldings, Baby Carriage Wheels, Metal Roofing and Side Panels, Metal Side Panel Caps, Metal Lath, Building Corner Beads, Window Ventilators, Rolling Steel Doors, Auto Brake Band Dust Covers, Pail Cover Hoops, Auto Lamp Door Bands, Hot Air Shutter Blades, Special Shapes, Z-Bars, etc.

Delivery speed 50′ to 200′ per minute. Material handled in cut lengths or from the coil

Built in many sizes.

KANE & ROACH

SYRACUSE, NEW YORK

Established 1887

STRAIGHTENING ROLLS—BENDING ROLLS—COLD ROLL-FORMING MACHINES



Designed and Built for the Continental Steel Corporation Kokomo, Indiana

The above 19-Inch Continuous Bar and Billet Mill, consisting of six stands, was designed and built by us complete from blooming mill runout table up to and including the cooling beds.

This is one of the most rugged designed mills of its kind in operation. Many features were incorporated, and as a result previous production records were broken.

THE MORGAN ENGINEERING COMPANY

ALLIANCE, OHIO, U. S. A.

Electric Traveling Cranes, Rolling Mill Machinery, Steam Hammers, Steam Hydraulic Forging Presses

Hydraulic Presses, Rock Crushers, Machine Work of all kinds, Special Machinery for any purpose.

New York: 125 Broadway Pittsburgh: 1420 Oliver Bldg.

Designers, Manufacturers and Contractors

"MACKINTOSH-HEMPHILL"

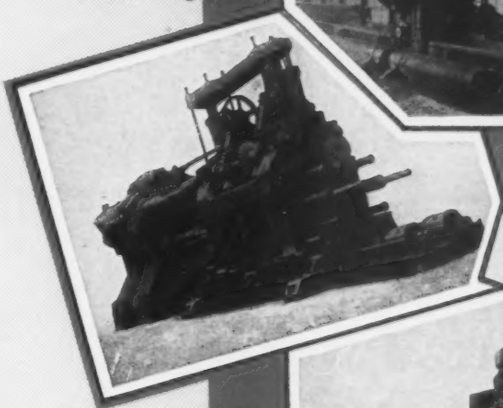


40" Blooming Mill
Center
35" Blooming Mill

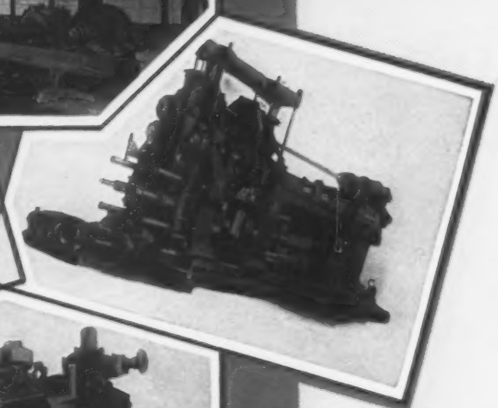


44" Blooming Mill

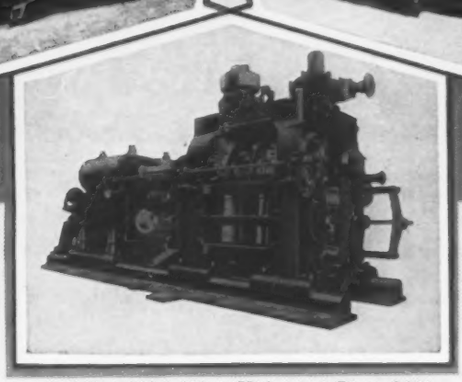




34" x 48"-2 High
Universal Mill



32" x 46"-2 High Reversing Universal Mill



25" x 42"-3 High Universal Plate Mill

ROLLS
GEARS
CASTINGS

STEEL
MILL
EQUIPMENT

Send Us Your Inquiries

MACKINTOSH-HEMPHILL COMPANY

ESTABLISHED 1803 AT PITTSBURGH

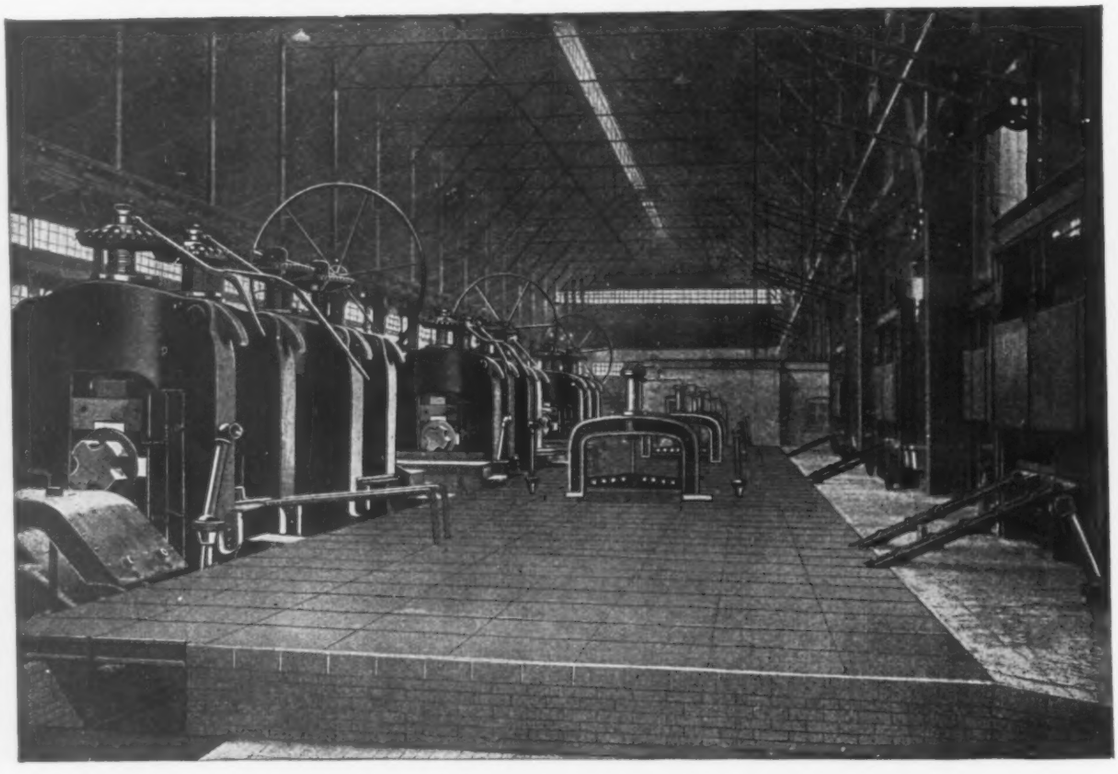
PIONEERS — ENGINEERS — BUILDERS

General Offices:
POINT BUILDIING—PENN AVENUE AT WATER STREET
PITTSBURGH, PA.

GARRISON PLANT, PITTSBURGH, PA.
MIDLAND PLANT, MIDLAND, PA.
WOOSTER PLANT, WOOSTER, OHIO.

NATIONAL

ROLLING MILL EQUIPMENT



Baird Water Cooled Floors for Sheet and Tin Mills

You will greatly facilitate your production by the use of Baird Water Cooled Standings. The improvement they effect in working conditions causes the workmen to do more and better work per day of service.

Baird Water Cooled Standings are temperature controlled. You can regulate them to suit either summer or winter weather. Installations can be easily made without changing the present layout of your mill.

In this partial list of users there is a total of 165 installations.

Follansbee Bros. Co., Follansbee, W. Va., and Toronto, Ohio; American Rolling Mill Co., Middletown, Ohio; American Sheet & Tin Plate Co., Vandergrift, Pa.; Jones & Laughlin Steel Co., Pittsburgh, Pa.; Otis Steel Co., Cleveland, Ohio; Republic Iron & Steel Co., Niles, Ohio; Mansfield Sheet & Tin Plate Co., Mansfield, Ohio; Universal Steel Co., Bridgeville, Pa.; Trumbull Steel Co., Warren, Ohio; Inland Steel Co., Indiana Harbor, Ind.; Falcon Steel Co., Niles, Ohio; National Stamping & Enameling Co., Granite City, Ill.; Reeves Mfg. Co., Dover, Ohio.

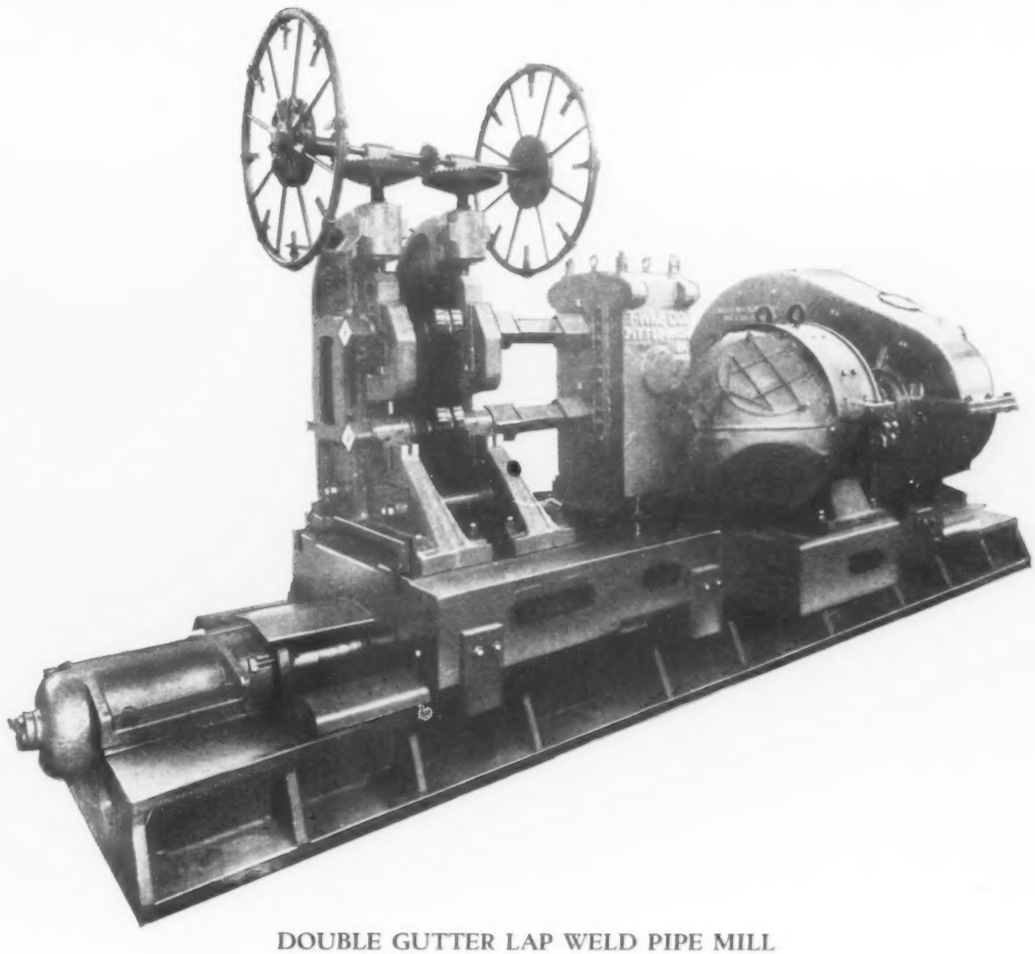
Send us your Specifications

NATIONAL ROLL & FOUNDRY CO.
AVONMORE, PA. U.S.A.

Manufacturers of

COMPLETE ROLLING MILL EQUIPMENT
HEAVY AIR FURNACE CASTINGS AND "BAIRD" WATER COOLED STANDINGS
CHILLED AND SAND ROLLS; STEEL AND ALLOY ROLLS; ACID OPEN HEARTH STEEL CASTINGS

PIPE MILL MACHINERY



DOUBLE GUTTER LAP WELD PIPE MILL

A mill of modern design having totally enclosed drive with anti-friction bearings

STRAIGHTENING PRESSES
MAGNETIC SKELP CHARGERS
HANDLING AND FEEDING DEVICES
COUPLING BORING AND TAPPING MACHINES
COUPLING SCREWING ON MACHINES
ACCUMULATORS AND INTENSIFIERS
SAWS, RACKS, TABLES, ETC.

REDUCING MILLS
BUTT WELD MILLS
HYDRAULIC TESTERS
CUTTING OFF MACHINES
THREADING MACHINES
CLIPPING SHEARS
LAP WELD MILLS

RAILWAY SPRING MACHINERY

TAYLOR-WILSON MFG. CO

ENGINEERS-FOUNDERS-MACHINISTS

MAIN OFFICE AND WORKS McKEES ROCKS, PA.

(PITTSBURGH DISTRICT)



"UNION"
CAST STEEL
TRUSS SUPPORTED ROOF
ANNEALING BOX

A Standardized Cast Steel Annealing Box designed from the accumulated experience of over twenty years in the manufacture of this type of equipment.

HERMETICAL SEAL insured with castings free from cracks or blowholes.

MAXIMUM PILING HEIGHT obtained by the patented "UNION" Truss Supported Roof.

MINIMUM WARPAGE assured by specially designed (patented) ribbing.

LONG LIFE secured under severe annealing temperatures by reason of the foregoing factors.

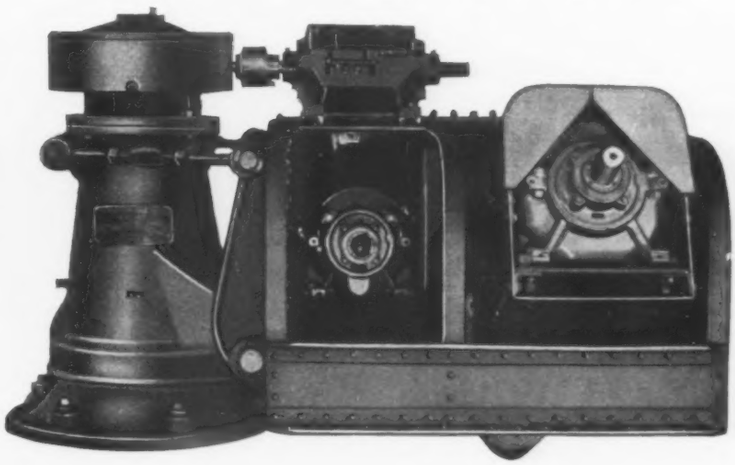
UNION STEEL CASTING CO.
Pittsburgh, Pa.

We also Manufacture Cast Steel Housings, Spindles, Annealing Bottoms, Coupling Boxes and General Rolling Mill Machinery Castings Up To 70,000 Lbs.

THE AMERICAN ELECTRIC ROTARY CLAY GUN

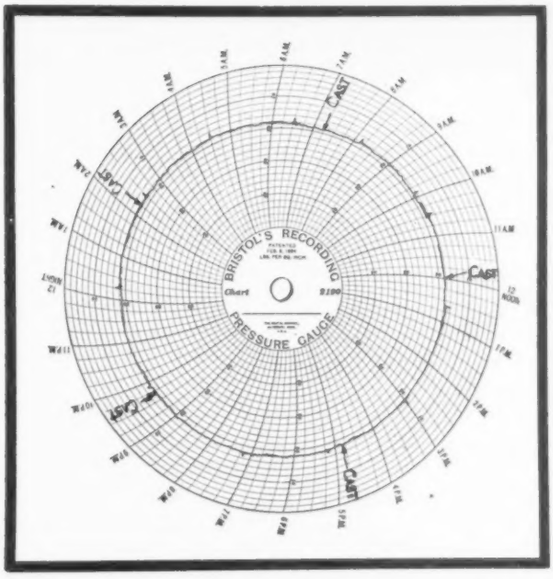
Is More Economical to Operate on the Modern Blast Furnace Than Any Other Type of Clay Gun

The Gun Carriage swings from an independent pedestal as shown and does not have to be adapted to and hung from the furnace column. Pedestal is erected on concrete foundation, eliminating all obstructions over the iron runner and in front of tapping hole.

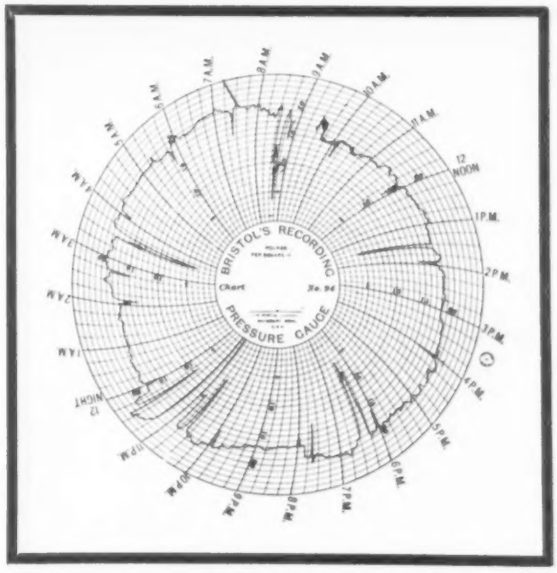


All motions are motor operated, with motors protected so that not one minute's delay has been charged to motors on twenty Guns operating.

Remote control guarantees safety and less hazardous labor for workmen.



Pressure Chart above shows continuous operation of a large furnace where tapping hole is plugged against full wind pressure with the American Electric Rotary Clay Gun. This chart shows the smooth operation of the furnace and indicates a continuous movement of the stock which results in greater tonnage.



Pressure Chart above shows results obtained when wind is checked to 3 or 5 pounds or taken completely off at casting time. Note how pressure builds up after cast and irregularity during entire cycle of 24 hours.

This Company manufactures various other types of efficient blast furnace equipment. Each and every product listed below is guaranteed. Send for individual circulars describing those in which you are interested. Their application to your particular needs will be shown by a general lay-out drawing without any obligation on your part whatever.

AMERICAN SAFETY CINDER NOTCH STOPPER
AMERICAN GAS SEAL FOR GAUGE RODS
AMERICAN MIXER AND RELIEF VALVE
AMERICAN LADLE SKULLING HOOK
AMERICAN COLD BLAST VALVE
AMERICAN PIG RELEASER

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THERMAL EXPANSION GOGGLE VALVE
SINGLE PASS HOT BLAST STOVE
McGEE CHIMNEY VALVE
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VREELAND METHOD AND PUG MILL
EQUIPMENT FOR HANDLING FLUE DUST

WILLIAM M. BAILEY COMPANY

ENGINEERS

MAGEE BUILDING, PITTSBURGH, PA.



Best materials. Careful manufacture.
Unexcelled facilities. Years of experience.
The quality of our crucibles insures satisfaction.
Your next order requested.
McCULLOUGH-DALZELL CRUCIBLE CO., PITTSBURGH, PA.



HAINES Micrometer Rolling Mill Gauges

Automatic



American and Foreign Standards

For Rolling Hot Plates. Used in the largest American and Foreign Plate Mills.

Send 30 cents for weight tables per square foot.

THE HAINES GAUGE CO., 119 So. 4th St., Philadelphia, Pa.

THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO.
ROD MILLS ~ DRAW BENCHES ~
WIRE DRAWING AND HANDLING EQUIPMENT.
FOR STEEL, COPPER AND ALLOYS.

Rolls **Air Furnace**
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HYDE PARK FOUNDRY
& MACHINE CO.
HYDE PARK - - - PA.

Castings **Ingot Molds**



PULL COUNTS HERE

Where steady production depends upon continuous power, the reliable service of a Caldwell Friction Clutch is indispensable. It pulls, and that's the main object of a clutch. But it pulls with the minimum of attention because the usual cause of clutch trouble—too many adjustments to be watched—does not exist in the Caldwell. *Send for catalog.*

W. E. Caldwell Co.
Incorporated
260 E. Brandeis St.
Louisville, Ky.

Caldwell FRICTION CLUTCHES



American Pulleys and Hangers will keep your plant running smoothly. Write for descriptive literature, list of dealers and catalog.

THE AMERICAN PULLEY COMPANY
4200 Wissahickon Ave., Philadelphia, Pa.

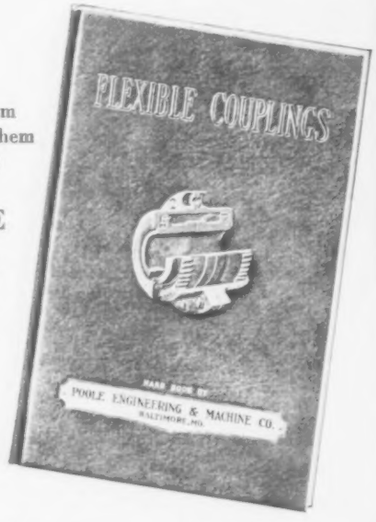
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PRESSED STEEL HANGERS | STEEL SPLIT PULLEYS
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FLEXIBLE COUPLINGS
How to judge them
How to compare them
Also describes

THE POOLE FLEXIBLE COUPLING
(Fully Patented)

You will find this book
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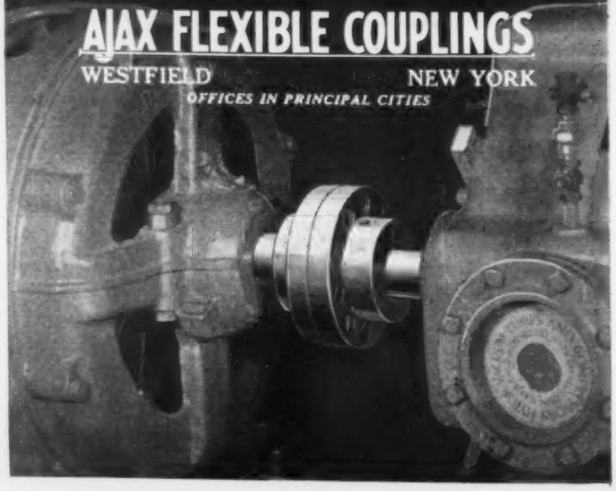


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POOLE ENGINEERING & MACHINE CO.
Baltimore, Md.

Uses Ajax Couplings

Most manufacturers of quality machinery have standardized on the Ajax Type "A"—Foote Bros., D. O. James, Lamson, Taber, Nash, Phillie Gear, Link-Belt, Brownhoist, Dings and many others have tested and accepted Ajax Flexible Couplings. Write for complete catalog.

AJAX FLEXIBLE COUPLINGS
WESTFIELD NEW YORK
OFFICES IN PRINCIPAL CITIES

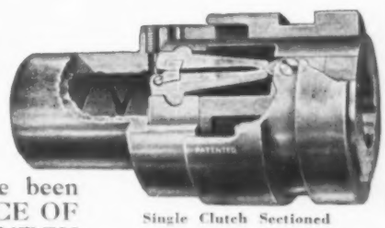


THE JOHNSON FRICTION CLUTCH

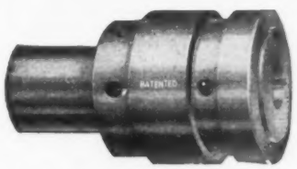
ATTENTION! BUILDERS OF METAL WORKING MACHINERY

Just A Few Words About

JOHNSON FRICTION CLUTCH IMPROVEMENTS

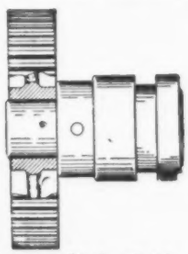


Single Clutch Sectioned

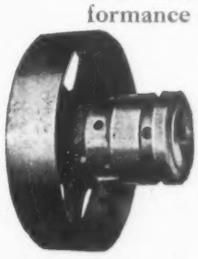


Single Clutch Exterior

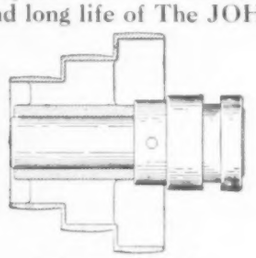
MINOR IMPROVEMENTS have been made from time to time, but the PRICE OF THE STANDARD JOHNSON CLUTCH has NEVER BEEN INCREASED. Perhaps it has been your practice to specify JOHNSON Friction Clutches in Your "Layouts" and have experienced the satisfactory performance and long life of The JOHNSON.—



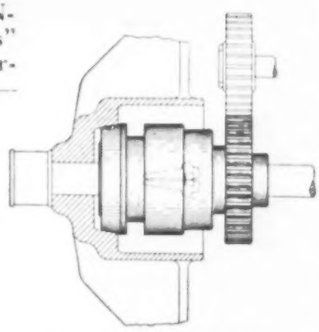
Single Clutch With Spur Gear



Single Clutch with Pulley Mounted



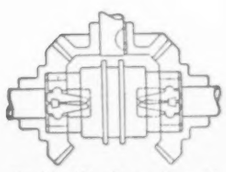
Single Clutch with Cone Pulley



Single Clutch with Braking Feature and Spur Gear



Double Clutch with Pulleys Mounted on Hubs



Double Clutch in Nest of Bevel Gearing



Double Clutch—Exterior



Double Clutch Between Bevel Gears

—If this is true it will please you to know that several MAJOR IMPROVEMENTS have recently been made to The "JOHNSON" which will add to its Excellent Performance and Long Life and allow of an Uninterrupted Satisfactory Service in the future — and — NO INCREASE IN PRICE.

IN SUBSEQUENT ADVERTISEMENTS we will describe these IMPROVEMENTS in detail.

Many users are profiting by these IMPROVEMENTS already.

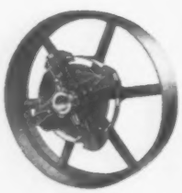
WRITE FOR CATALOG "RED-1"

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

FALLS

POWER TRANSMISSION MACHINERY FOR LIGHT, MEDIUM, HEAVY AND SPECIAL SERVICE

ENGINEERING AND MANUFACTURING A COMPLETE LINE OF

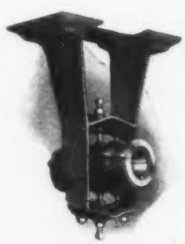


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THE FALLS CLUTCH & MACHINERY CO.
CUYAHOGA FALLS, O.

NEW YORK CITY 5-7 FRANKLIN ST. | BOSTON, MASS. 52-58 PURCHASE ST. | CINCINNATI, O. 208-214 ELM ST. | DENVER, COLO. 208 MACK BLDG.

IMPROVE YOUR OPERATING METHODS



You can have unit control of every machine in your shop with a clutch your workman can depend upon. Thirty years of successful operation of Schultz Clutches have convinced our customers that for durability and simplicity of construction the Schultz is unexcelled. Write for catalog.

A. L. SCHULTZ & SON 1675 ELSTON AVE. CHICAGO, ILL.

Maybe It's in the

CLASSIFIED SECTION

If you can't find it in the regular advertising pages of The Iron Age—look in the Classified Sections at the back of this book. . . . . .

THE CLASSIFIED SECTIONS *of* THE IRON AGE

LOOKING FOR SOMETHING THAT'S HARD TO LOCATE?

Want to buy used machinery? Looking for somebody's surplus materials at reduced cost? Want to buy a factory building? Going to add a salesman or production man to your staff? Thinking about letting out some machine work on contract? Then thumb through the pages of the Classified Sections in the back of this book where these and other special services are advertised.

THE CLASSIFIED SECTIONS *of* THE IRON AGE



Simplified Engineering

BEING unusually compact, Model C.C. clutches can be laid into the limited spaces usually available in machine tools, and yet provide ample capacity for the efficient operation of the tools.

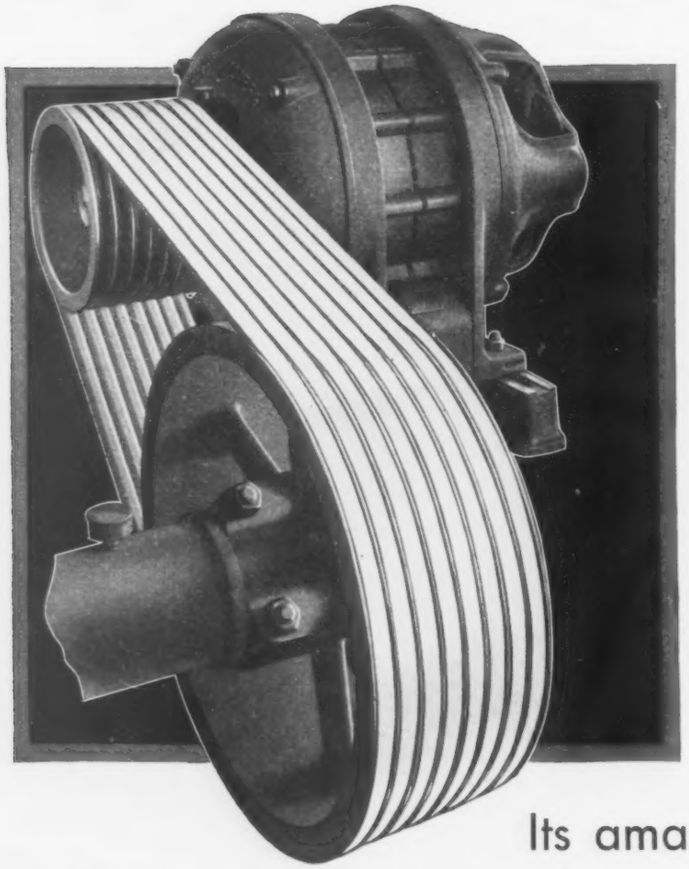
This feature reduces to a minimum the need for changes in machine tool design or appearance to accommodate a clutch, and in other ways simplifies the engineering of a clutch into the machine.

Operating in a spray of oil, C.C. clutches are entirely self lubricating. They require only infrequent adjustments which are quickly made. These features contribute to full time operation of the machine.

They can be furnished in 3½", 4½", 5", 5½", 6", 7", and 9" effective diameter sizes, single or duplex. Complete information about sizes and capacities will be sent on request. Write.

TWIN DISC CLUTCH COMPANY

RACINE WISCONSIN



Texrope Belts and Sheaves are carried in stock at points from which the entire country can be served promptly. Standard drives from 2 to 100 H. P. are thus available. Quick delivery can be made on larger drives.

Over 70,000 in service

Its amazingly rapid acceptance is the most Convincing Recommendation for Texrope

APPROXIMATELY four years ago Texrope Drive was announced to industry.

Today over 70,000 Texrope Drives are in service . . . giving more satisfactory performance than any other method of transmission . . . In every industry the trend is definitely toward Texrope.

In plants where flat belts last only a few weeks, Texropes are giving continuous service. Replacements are infrequent and inexpensive.

Where moisture or dirt is unavoidable, Texrope Drives operate with no loss in efficiency. Requiring no lubrication, the maintenance cost on Texropes is practically nothing . . and the drive is always clean, positive and silent.

From the fractional horsepower drives to heavy duty on crushers, mining machinery, oil line pumps and paper machinery, Texrope Drives are giving continuous service at amazingly low cost.

See How Texrope Solves Transmission Problems

Texrope Drive consists of a driving and a driven sheave, grooved for V-shaped endless Texrope belts of rubberized cord fabric. Power is transmitted, with no slippage, by the wedging contact of the belts in the V-shaped grooves. The result is a short center drive with an efficiency of 98.9 per cent, requiring practically no maintenance and infrequent adjustment.

Continuous operation is assured. One or two belts may wear out after long service, but the remaining belts will carry the load until replacement is convenient. With Texrope it is possible to use a higher speed motor, with a consequent saving in cost . . . Texrope is rightly termed "The Perfect Transmission for Every Purpose". It will save money for you. Send for a copy of Bulletin 1228-K.

ALLIS-CHALMERS MANUFACTURING CO., (*Texrope Division*) Milwaukee, Wis.

Builders of Power Machinery Since 1846

ALLIS-CHALMERS

TEXROPE DRIVES

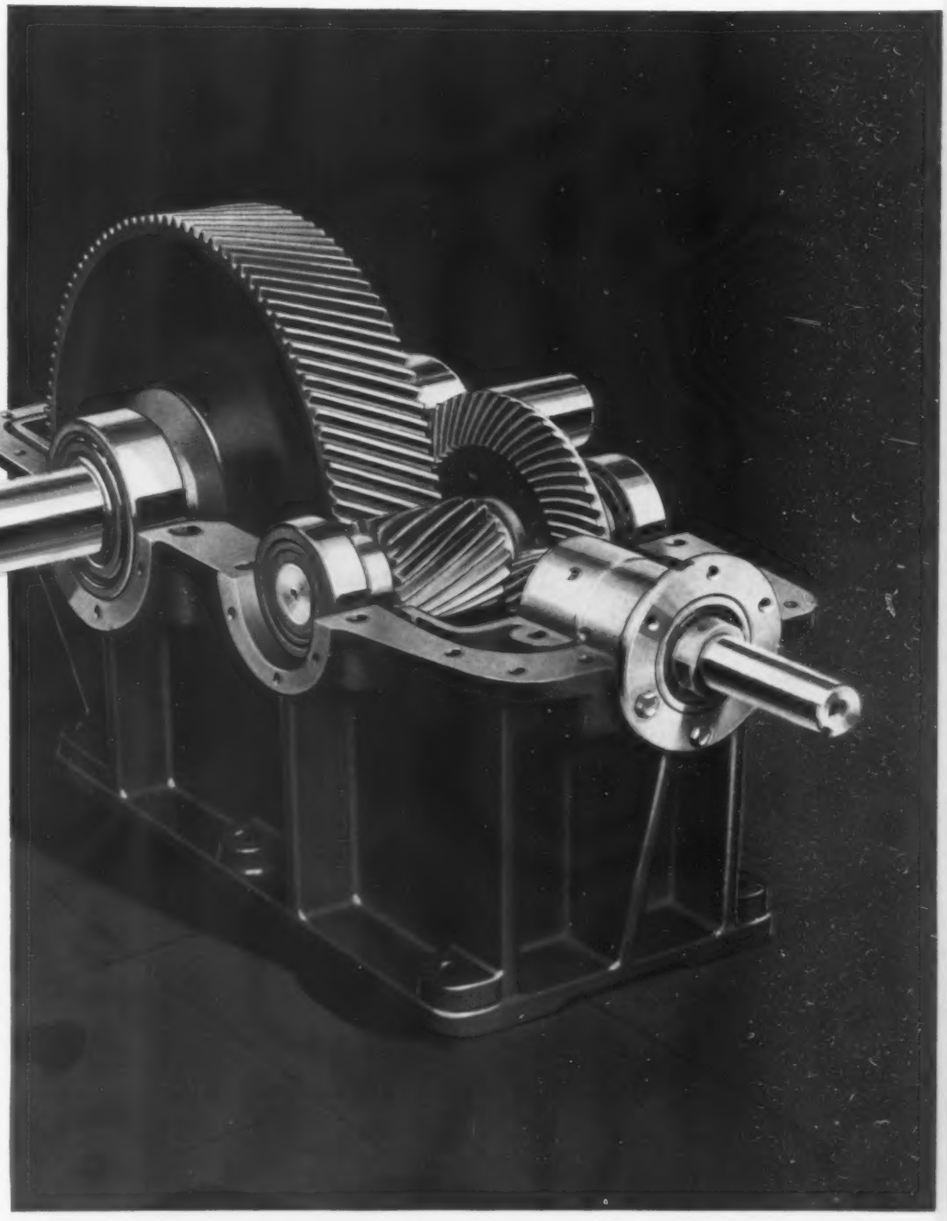
THE PERFECT TRANSMISSION — ALLIS-CHALMERS TEXROPE DRIVE — FOR EVERY PURPOSE

It Pays to Consult Falk First!

There is a Falk Speed Reducer now available for practically every kind of service . . . Falk Speed Reducers of the parallel shaft type have always been outstanding in their efficiency . . . Based upon actual service records, these speed reducers have established an average of 96½% to 98½% efficiency in power delivery.

Now Falk Engineers have developed a Right Angle Drive Speed Reducer

The new Falk Right Angle Drives are distinctly Falk in design, and embody all the proved Falk principles of good engineering . . . This unit is highly practicable where space conditions prohibit anything but a gear drive having low and high speed shafts at right angles . . . Under such conditions the Falk Right Angle Drive is preferred to a worm drive because of Falk ruggedness, efficiency, and cool operation . . . It is of typical Falk quality in every sense of the word, and will deliver the same quiet trouble-free performance for which Falk Parallel Shaft Reducers are noted . . . The Right Angle Drive series consists of single, double, and triple-reduction types, with ratios from 1.5:1 to 518:1 . . . Roller bearings are used for all bearing surfaces, to best serve this type of drive . . . The Falk Corps of Engineers will co-operate with you in adapting efficient Falk Drives to your power transmission requirements.

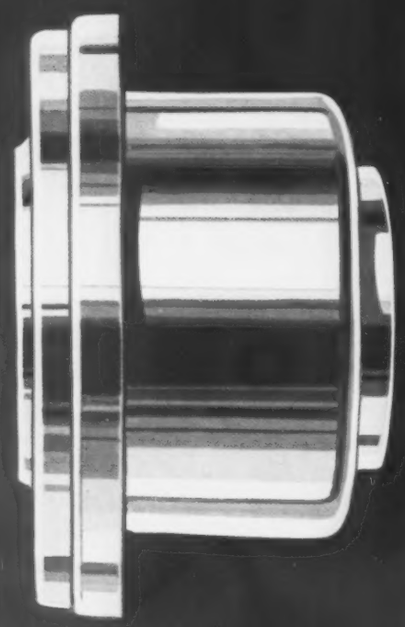


FALK

SPEED REDUCERS

Falk Herringbone Gear Speed Reducers are carried in stock in a wide range of ratios and sizes. Specifications for exceptional sizes, ratios and capacities will be submitted upon request by any Falk representative.

SIMPLICITY—FOR SERVICE



The Falk Flexible Coupling is designed to deliver the greatest possible service under the most difficult working conditions . . . Simplicity is the reason for its success . . . The Coupling consists only of two flanged and grooved steel hubs (each keyed for its shaft), into which fits a tempered steel spring. A cover fits over these hubs . . .

This patented assembly ensures exceptional resiliency with great strength, ease of installation, low upkeep cost and dependable operation . . . Falk Flexible Couplings are made in standard sizes from 1/5 H. P. to 18,000 H. P. at 100 R. P. M. . . . Send for Falk Coupling Bulletin No. 180.

What Falk Flexible Couplings Do!

Allow both lateral and torsional elasticity . . . Are easily connected and disconnected . . . Are all-steel . . . Provide widest distribution of pressure . . . Allow most correct lubrication . . . Float freely under load . . . Insure greatest resistance to overloads . . . Absorb shock and vibration . . . Accommodate parallel and angular misalignment . . . Can be lined up quickly without special tools . . . Cannot rust—springs are packed in grease . . . Have no unreliable elements, which lead to breakdown . . . Operate equally well in both directions; either end can be the driver.

Other Falk Products—Gears, Speed Reducers, Oil Engines, Steel Castings

THE FALK CORPORATION—Milwaukee

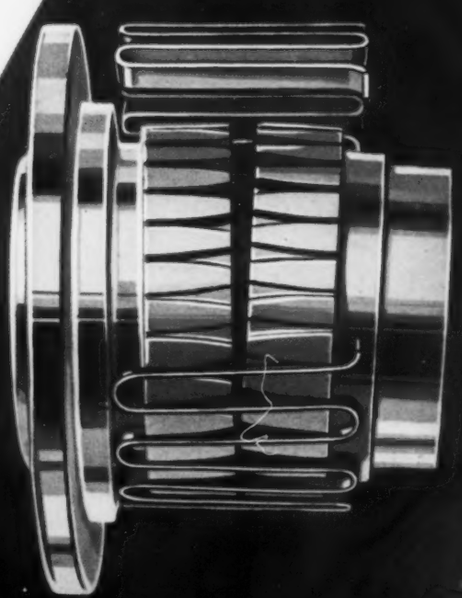
NEW YORK WILKES-BARRE AKRON CHICAGO BIRMINGHAM SEATTLE
BOSTON PITTSBURGH DETROIT MINNEAPOLIS HOUSTON LOS ANGELES
ALBANY CLEVELAND KALAMAZOO ST. LOUIS DENVER SAN FRANCISCO
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Canada: The William Kennedy & Sons, Ltd., Owen Sound, Ontario.
Exclusive Sales Representatives and Licensed Manufacturers under Falk Patents

Branches: HALIFAX TORONTO MONTREAL COBALT WINNIPEG VANCOUVER

FALK

FLEXIBLE COUPLINGS



Falk Flexible Couplings will soon be available through mill, machinery and electrical supply houses, thereby further widen-

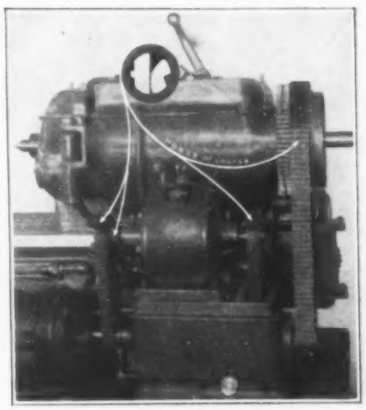
Harness Your Power *with* MORSE *SILENT CHAINS*

You have power to harness and put to work on waiting machines. How are you going to do it to get the most efficient performance and dollar-for-dollar value in work done, lowered maintenance cost and dependable operation?

MORSE Silent Chains will answer your power transmission problems for you better than any other form of mechanical drive. They deliver 98.6% of the power to the point of use, at a positive speed ratio between driving and driven shafts. They are flexible, quiet at high speeds, unfailingly dependable in performance over long periods of time. And they are reliable, long-lived, and cheaper to maintain *all* the time.

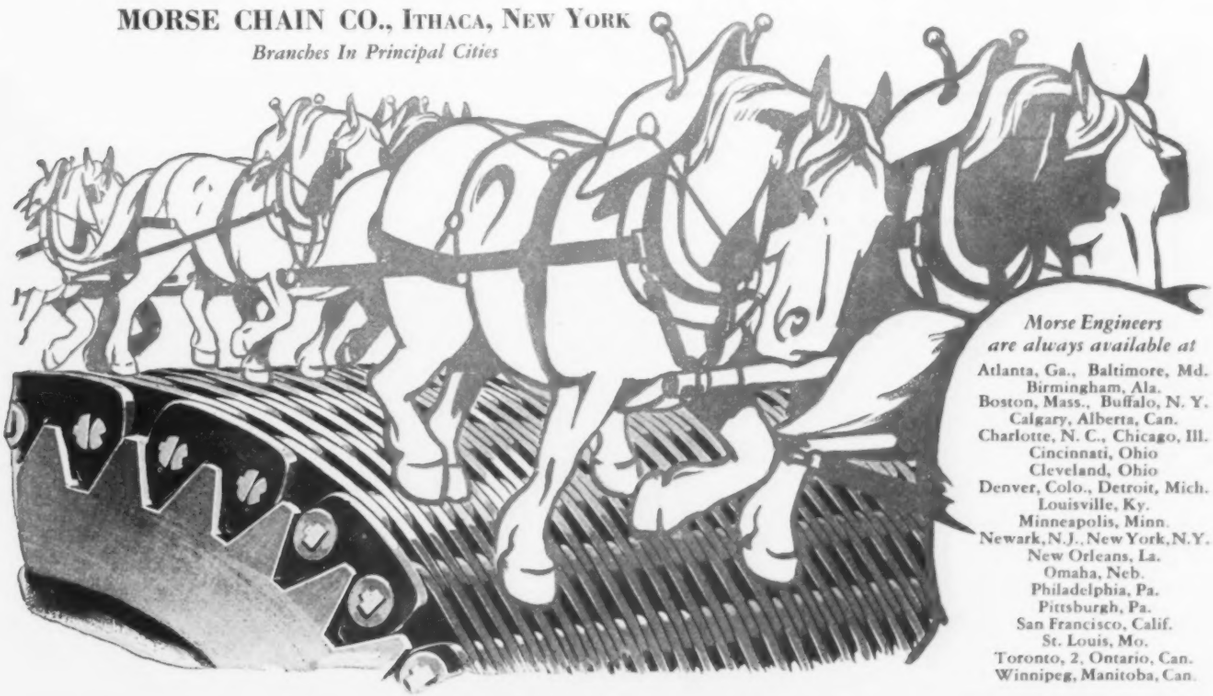
The MORSE engineering staff specializes on the problems of power transmission. Their study of your needs, and their recommendations will obligate you in no way beyond the time you will spend with them.

A free data file, containing complete information on MORSE Silent Chains—how they are designed, how installed, and how to use them—will be sent you on request. Ask for it.



Four Morse Silent Chains are used on this Monarch lathe in the plant of the Cadillac Motor Car Co.

MORSE CHAIN CO., ITHACA, NEW YORK
Branches In Principal Cities



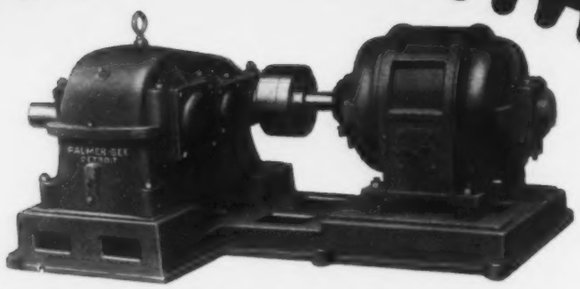
Morse Engineers are always available at

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Birmingham, Ala.
Boston, Mass., Buffalo, N. Y.
Calgary, Alberta, Can.
Charlotte, N. C., Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Denver, Colo., Detroit, Mich.
Louisville, Ky.
Minneapolis, Minn.
Newark, N.J., New York, N.Y.
New Orleans, La.
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San Francisco, Calif.
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Toronto, 2, Ontario, Can.
Winnipeg, Manitoba, Can.

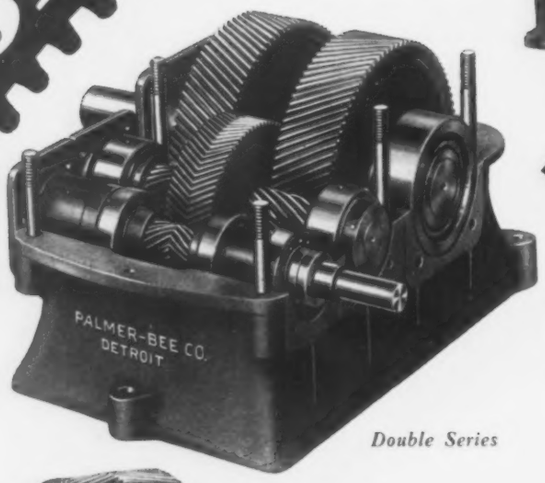
MORSE SILENT CHAIN DRIVES

Be sure to visit the Morse Chain Company Exhibit at the Road Show, Atlantic City, January 11 to 17, inclusive

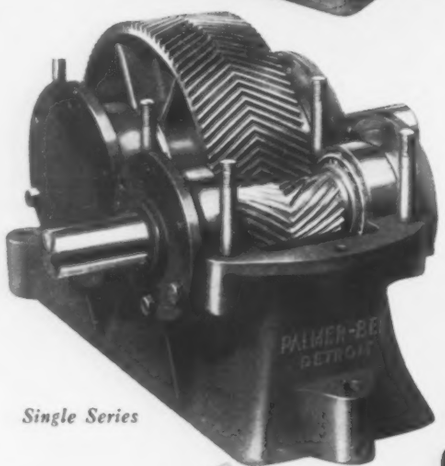
PALMER-BEE SPEED REDUCERS



Double Series Reducer Mounted on Cast Iron Base



Double Series



Single Series

IN your quest for power transmission equipment that will lower your operating expenses for 1930, you will do well to give serious consideration to Palmer-Bee Herringbone Speed Reducers.

These units are the outstanding development in the speed reducer field. They are strong, dependable, efficient and economical.

They deliver within a fraction of the total input power to the driven machine . . . stand up month after month the year around with practically no attention . . . occupy very little floor space . . . are immune to dust, dirt and grit that shorten the life of exposed drives . . . and eliminate the accident hazard to employees.

Mail the coupon . . . or request an engineer to call.

Offices in New York, Chicago, Philadelphia, St. Louis, Cincinnati, Pittsburgh.

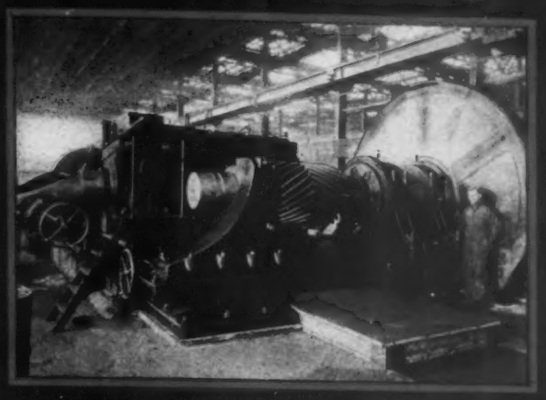


PALMER-BEE COMPANY
1700-16 Poland Ave., Detroit, Mich.

PLEASE mail me a copy of your Speed Reducer Catalog.

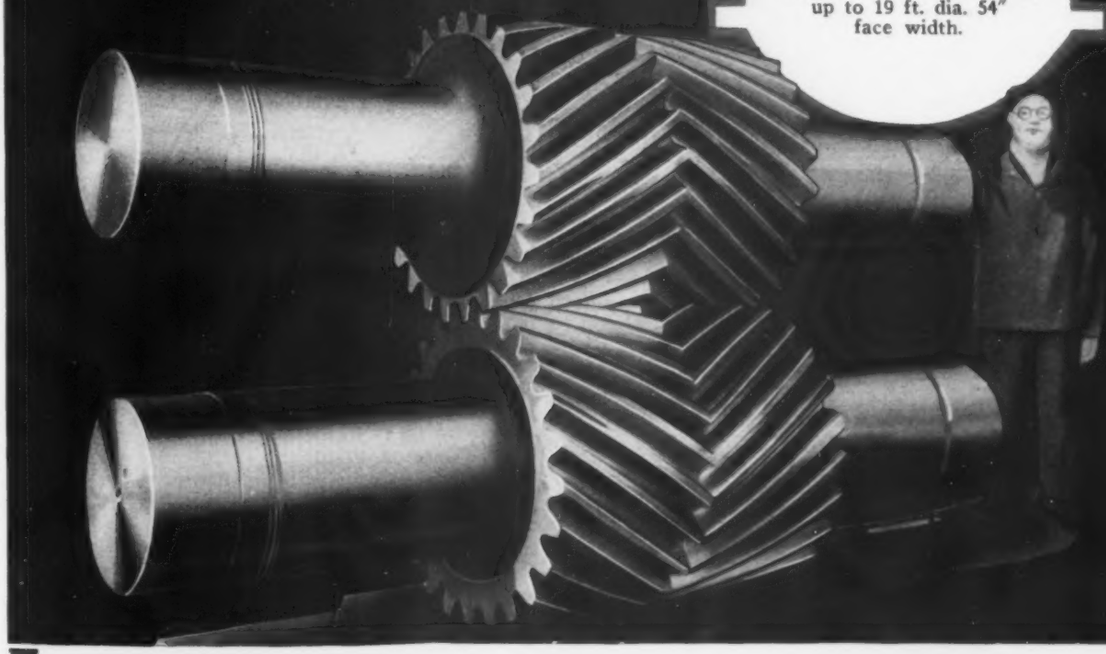
Company .....
Individual .....
Position .....
Address .....

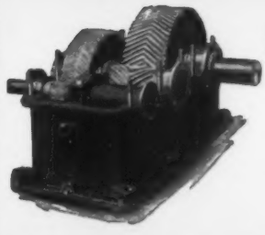
Accurately Generated Blooming Mill Pinions



THE Sykes gear generating machines have gained a world wide reputation for producing high class gears. Until recently they had one limitation—the size of pitch which could be cut was limited to 1 DP or 3" circular pitch.

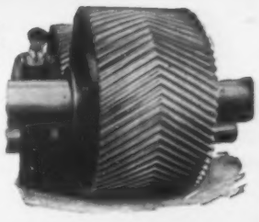
This limitation is now removed. The largest machine (recently built) cuts up to 5½" circular pitch, up to 19 ft. dia. 54" face width.





Complete Series of Speed Reducers up to 5000 H.P.

Herringbone Gears up to 228" Diameter, 4¼" cap. in any Materials Suitable for Gears.



ASK FOR OUR NEW SYKES GEAR GENERATOR CATALOG

FARREL-BIRMINGHAM CO., Inc.

SUCCESSOR TO

FARREL FOUNDRY & MACHINE CO., ANSONIA, CONN., AND BUFFALO, N. Y., AND BIRMINGHAM IRON FOUNDRY OF DERBY, CONN.

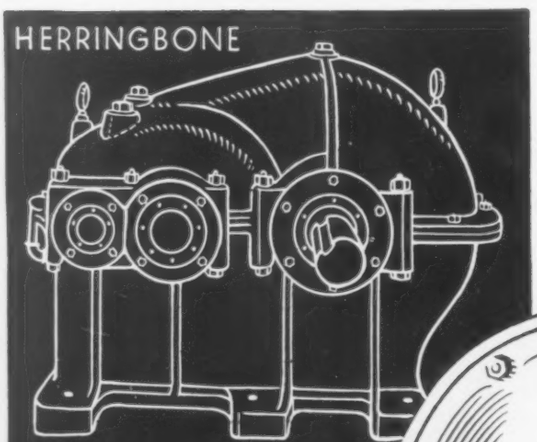
ADDRESS REPLIES TO THIS ADVERTISEMENT TO BUFFALO PLANT

344 VULCAN ST., BUFFALO, N. Y.

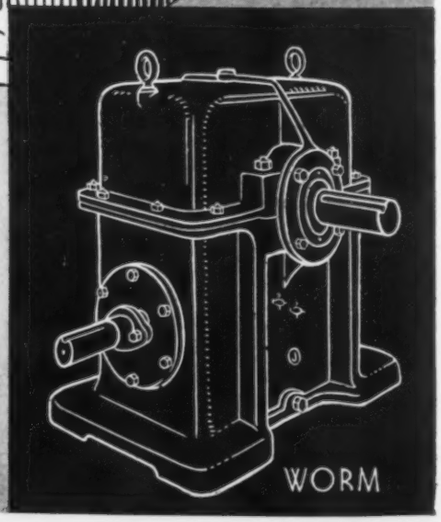
PERFORMANCE

When you install a Jones Spur Gear Speed Reducer—a simple, quick and inexpensive job—you put to work a machine that needs no coddling. It will stand the grind for many years with no attention except infrequent refilling of the oil chamber. The gears are extra strong, accurately cut, perfectly meshed, and fully protected by a dust-proof housing. Saves space. Prevents accidents. Conservatively rated to stand heavier than normal loads when necessary. More than 2,000 standard ratios carried in stock. But—if a worm or herringbone gear reducer is the kind you need—you can get it just as quickly. Write us about your requirements.

W. A. JONES FOUNDRY & MACHINE CO.
4434 W. Roosevelt Road · · Chicago, Illinois



Jones
SPUR-WORM-HERRINGBONE
REDUCERS





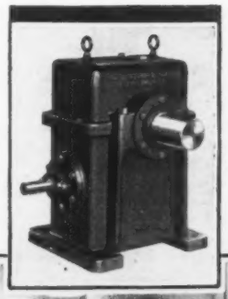
H & S Speed Reducers

Help Make $7500 Yearly Saving

IN the rebuilding of the Bessemer Plant of Metropolitan Paving Brick Co., improved equipment made possible a saving of 150 to 200 kw.hrs. per day . . . a saving of $7,500 per year. And prominent among these improvements is direct drive through Horsburgh & Scott Speed Reducers.

Totally enclosed, these reducers are permanently protected against moisture and abrasive dust. Filled with lubricant, they run for a long period with no further attention. These features are equally valuable in any industry where economy is desired and where operating conditions are severe.

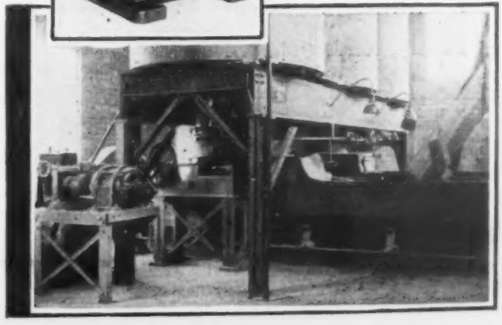
Our Engineering Department will gladly give you the benefit of our wide experience, helping you to select the type and size of gears and speed reducers best suited to your requirements.



The Horsburgh & Scott Co.

Gears and Speed Reducers

Cleveland, U. S. A.



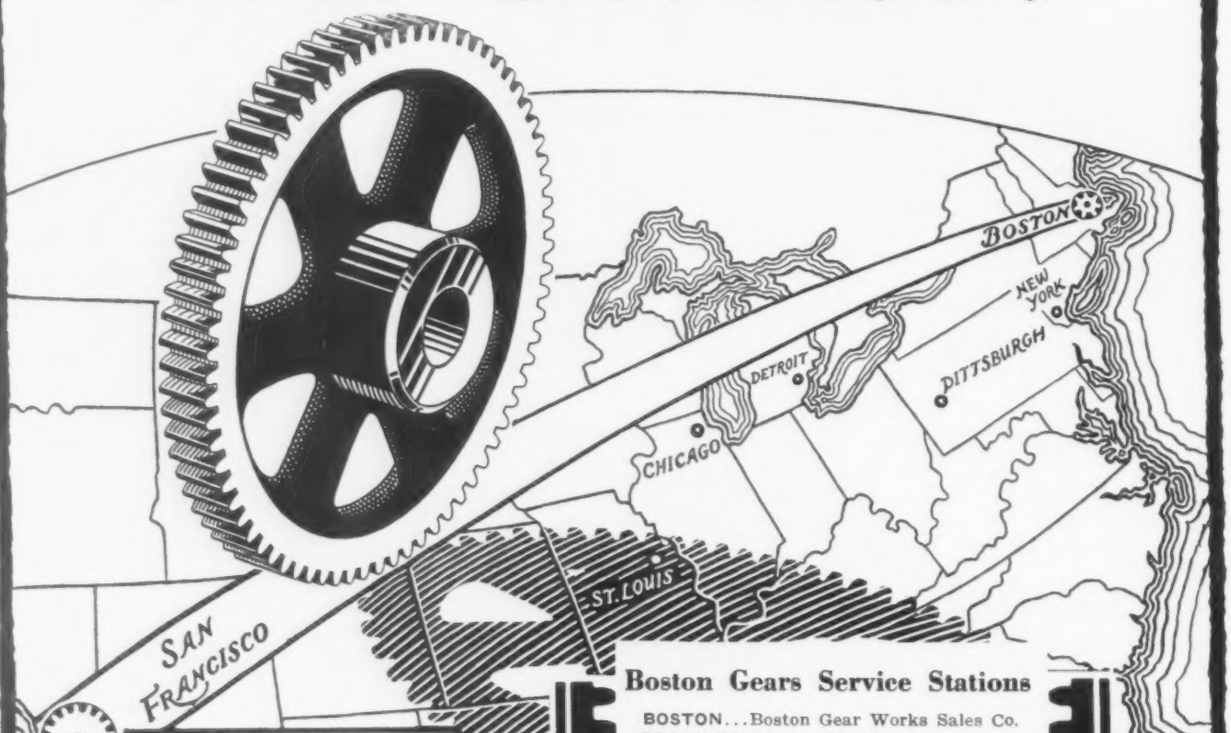
A typical installation of Horsburgh & Scott Worm Gear Speed Reducers in the Bessemer Plant of the Metropolitan Paving Brick Co.



This loose-leaf catalog describes and illustrates the full line of Horsburgh & Scott Speed Reducers, and contains engineering data that will be valuable to you. Write for it.

STANDARDIZATION PAYS

A Nation-wide Gear Service!



EVERY year more machine tool builders and users realize the value of Boston Standardized Gears. This unique nation-wide stock gear service saves them time, trouble and expense.

BOSTON standardized products now include gears, speed reducers, chain drives, sprockets, couplings, joints, shaft supports, pulleys and bearings, *all from stock.*

CATALOG 48 gives full data for ordering. Send for a copy.

Boston Gears Service Stations

BOSTON...Boston Gear Works Sales Co.
PROVIDENCE.....Machine Parts Corp.
WORCESTER.....Brierly-Lombard Co.
SPRINGFIELD...E. S. Stacy Supply Co.
NEW HAVEN.....C. S. Mersick & Co.
NEW YORK
Boston Gear Works Sales Co.
PHILADELPHIA
Boston Gear Works Sales Co.
BALTIMORE
Carey Machinery & Supply Co.
PITTSBURGH..Somers, Fitler & Todd Co.
BUFFALO.....Root, Neal & Co.
TOLEDO
The Kirkby Mach'y & Supply Co.
DETROIT.The Chas. A. Strelinger & Co.
CLEVELAND
Boston Gear Works Sales Co.
Strong, Carlisle & Hammond Co.
CHICAGO..Boston Gear Works Sales Co.
CINCINNATI.....Queen City Supply Co.
DAYTON...Patterson Tool & Supply Co.
INDIANAPOLIS....Vonnegut Hdwe. Co.
MILWAUKEE
The Western Iron Stores Co.
ST. LOUIS....Schroeter Bros. Hdwe. Co.
LOS ANGELES..Andrews Hardware Co.
SAN FRANCISCO.....C. W. Marwedel

Main Office and Factory, North Quincy, Mass.

BOSTON GEARS

EARLE PRODUCTS



EARLE BEVEL AND MITER GEARS AND PINIONS (left)

Special attention is given to the accurate finishing of all machined surfaces, adding to life and efficiency. They can be obtained in all sizes from ½" to 13 ft. in diameter.

SPUR GEARS AND PINIONS (right)

The Earle method of cutting teeth—generated, hobbed, planed or rotary cut—eliminates thick and thin teeth. Made in plain, webbed, and spoked patterns, ½" to 34 ft. diameter, from any practical gear material. A large stock of patterns insures prompt service.





HERRINGBONE GEARS AND PINIONS

A feature of Earle Herringbone Gears is quiet operation.

Power losses are minimized.

Sizes: ½" to 30'. Three general types:

1. Without groove in center (Earle bolted together type).
2. With groove and staggered teeth.
3. With groove and mating teeth.

BRIDGE OPERATING MACHINERY AND POWER UNITS

We build operating machinery for all types of movable bridges, gates, locks, dredges, large valves, etc.

The Earle Power Unit, gasoline or motor driven, for example, meets this need efficiently and dependably. Motor and transmission box are mounted on a compact base. The unit is adaptable to various requirements.

OTHER EARLE PRODUCTS

Spiral Gears and Pinions	Non-metallic Gears and Pinions
Racks—Curved and Straight	Speed Reducers
Sprockets, Ratchets, etc.	Special Machinery

Write for Booklets

"LEA SIMPLEX" COLD METAL SAW (left)

Will saw round stock, rails and structural steel into intricate shapes that would be impossible with an ordinary saw. Stock can be clamped accurately and firmly in jig time. Built in 5 sizes for 5½ to 11 in. rounds, 5 to 10 in. squares and 9 to 20 in. I-beams on flat. Send for booklet "Economy in Cold Sawing."

WORM GEARS AND WORM WHEELS (right)

For ordinary service we recommend a cast iron worm gear and a steel worm; for high speeds or extra heavy duty a bronze worm gear and a steel worm. Earle Worm Wheels are made in sizes from ½ in. to 30 ft. in diameter.

May we quote on your requirements?





THE EARLE GEAR & MACHINE CO.

4715 Stenton Ave., Philadelphia, Pa.

BRANCH SALES OFFICES:

110 State St. Boston, Mass.
95 Liberty St. New York City
Farley Bldg. Birmingham, Ala.
P. O. Box 141 Plymouth, Pa.



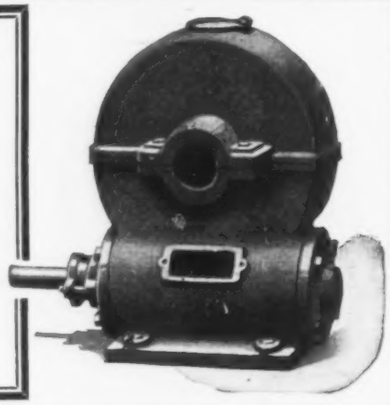
HINDLEY WORM GEARS

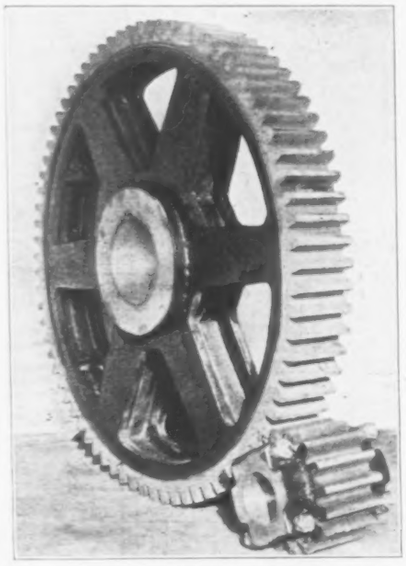
Send us your Inquiries for

WORM GEARS AND
WORM GEAR REDUCTIONS

Catalogue on Request.

HINDLEY GEAR COMPANY
ENGINEERS
508 N. 19th Street
Philadelphia





AKRON

AKRON GEARS

Mean Fewer Gear Replacements

We make them with the thought of "Service" constantly in mind. That's why every Akron Gear, large or small, gives the kind of service that keeps things going.

Let us quote on your requirements.

The Akron Gear & Engineering Co.
Akron, Ohio



"Penmaid"

GEARS

Noiseless Gears
of
Condensite Celoron
Spiral, Spur and Bevel
Gears of all metals.
Sprockets and Chains.
Heat treating of every description.

Established
1908

Pennsylvania Gear & Machine Co., Inc.
2239-49 E. Tioga St. Philadelphia, Pa.

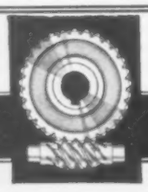
GEARS—WORMS—CAMS

CUT TO ORDER



HARTFORD GEARS

SEND BLUEPRINTS FOR ESTIMATES
THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD CONN.



SPEED REDUCERS

CLEVELAND
WORM AND GEAR COMPANY

3252 EAST 80th STREET ♥ CLEVELAND, OHIO

Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

Branch Sales and Engineering Offices:
New York, 12 E. 41st St. Pittsburgh, Farmers Bank Bldg.

GRANT GEAR WORKS

Prompt Attention

both to special work and to orders from our Complete Stock of

Spurs Worm Gears
Bevels Reduction Units

Second & B Sts., Boston, Mass.

GEARS

Spur - Helical - Bevel - Worms - Screws - Racks
Gear Hobbing - Thread Milling - Broaching

THE ADAMS COMPANY (Est. 1883)
1900 Iron St., Dubuque, Iowa

FERGUSON GEAR CO.

CUT GEARS CHAIN DRIVES
BEVEL SPUR SPIRAL WORM SPROCKETS
RAWHIDE, BAKELITE AND HARDENED STEEL PINIONS
Member American Gear Manufacturers Association
GASTONIA, NORTH CAROLINA

TESTED CHAINS ONLY
BRADLEE & CO., Inc.
1615 N. Delaware Ave., PHILADELPHIA, PA.
Sole Manufacturers of D.B.G. Special Crane Chain
Hand Made Iron Chain — Ship Cable, Marine Railway Crane, Dredging and Slings

FOR INCREASED PRODUCTION
"WHITNEY"
SILENT CHAIN DRIVES
POSITIVE FLEXIBLE DURABLE
THE WHITNEY MFG. CO. Hartford, Conn.

THOMAS MORTON
247 Centre Street
QUALITY NEW YORK • CHAINS


SPROCKETS
Complete Stock for Immediate Delivery
Our stock of gears and sprockets is complete in every way. Send us your order or inquiry for any size.
DUNDORE MANUFACTURING CO.
244 Orange St. Reading, Pa.

CHAMBERSBURG-NATIONAL
COMPLETE FORGING EQUIPMENT
CHAMBERSBURG ENGINEERING CO. CHAMBERSBURG, PA.
THE NATIONAL MACHINERY CO. TIFFIN, OHIO
Sales Offices
NEW YORK, 152 W. 42nd St. CHICAGO, 565 W. Washington St.
DETROIT, 2457 Woodward Ave.


MOLOCH POWER HAMMERS
A Moloch Hammer in your shop will be an asset as long as the shop lasts. Guaranteed to give satisfaction, these hammers are real investments in service.
Belt or Motor Drive, made in sizes from 25 lbs. to 500 lbs.
MOLOCH FOUNDRY & MACHINE CO.
Kaukauna, Wis.



Greetings

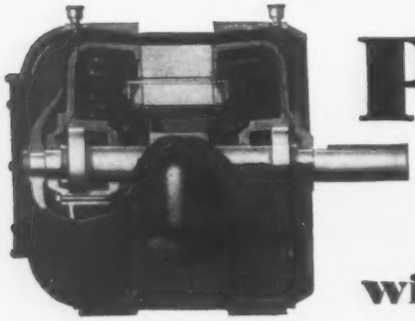
For many generations it has been the custom to set aside January 1st as a day of celebration—a time to pause and take stock of what has gone before — a day to gather strength for an enthusiastic start on a new year.

As you pause on New Year's Day to greet the "infant" so do we, and for the same reason; thankful in our hearts for a highly successful 1929 and filled with justified optimism for 1930.

To our friends, both old and new, we extend Greeting and our Very Best Wishes

The Leland Electric Co.
Dayton·Ohio·U·S·A·

Leland
fractional horsepower
Motors



Permanent Protection

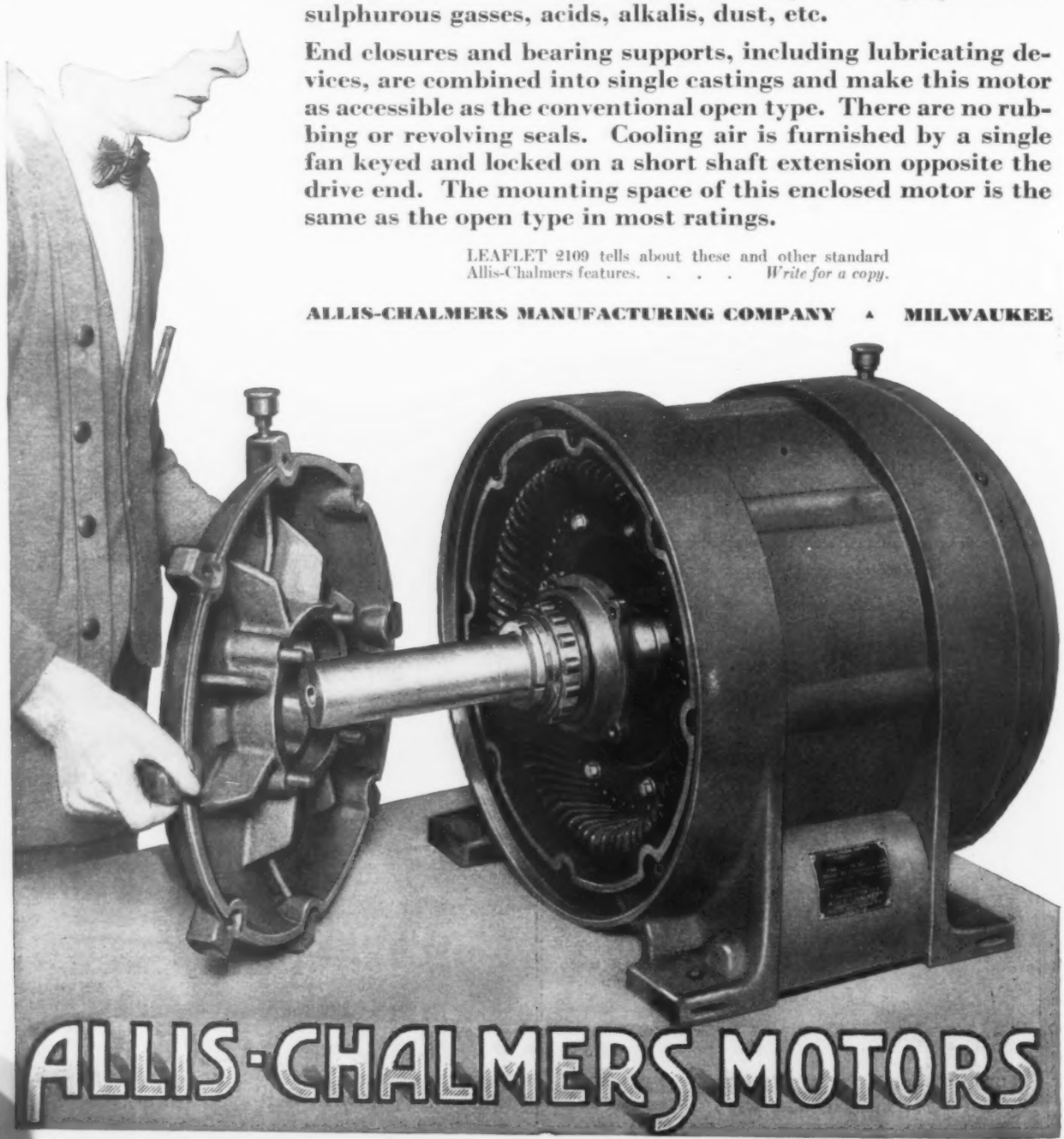
without sacrificing accessibility

. . . that was the thought in mind when the Allis-Chalmers type "ARZ" motor was developed. The active parts of this motor are completely enclosed, protecting the stator windings and the rotor — those parts that are subject to injury — from sulphurous gasses, acids, alkalis, dust, etc.

End closures and bearing supports, including lubricating devices, are combined into single castings and make this motor as accessible as the conventional open type. There are no rubbing or revolving seals. Cooling air is furnished by a single fan keyed and locked on a short shaft extension opposite the drive end. The mounting space of this enclosed motor is the same as the open type in most ratings.

LEAFLET 2109 tells about these and other standard Allis-Chalmers features. . . . *Write for a copy.*

ALLIS-CHALMERS MANUFACTURING COMPANY ▲ MILWAUKEE





20 Horse Power Century Type SCN
Squirrel Cage Induction 3 and 2 Phase 60 Cycle Motor

Low Starting Current

Normal Torque . . . General Purpose

When a Century Type SCN Squirrel Cage Induction 3 and 2 Phase Motor is thrown directly across the line, in 30 horse power and smaller sizes, the starting current is within N. E. L. A. recommendations . . . . The starting torque of the Type SCN Motor is practically the same as that of the standard Type SC Motor.

Therefore, Century Type SCN Squirrel Cage Induction Motors are particularly suitable where a normal starting torque is satisfactory, and less starting equipment is desirable.

Century Type SCN Motors, 30 horse power and smaller sizes, are more economical to install and maintain, because they require no current-limiting starting equipment . . . . They take full advantage of the current drawn from the line, because no current is dissipated in starting equipment . . . . Line disturbances are lessened. Built in standard sizes from 7½ to 75 horse power.

CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.

40 U. S. and Canadian Stock Points and More Than 75 Outside Thereof

Century MOTORS

"THEY KEEP A-RUNNING"

Cut Costs *from Production to Storage* with Industrial Trucks



One efficient little tractor, Exide - Ironclad - equipped, releases from one to ten men for more productive work than materials-handling.

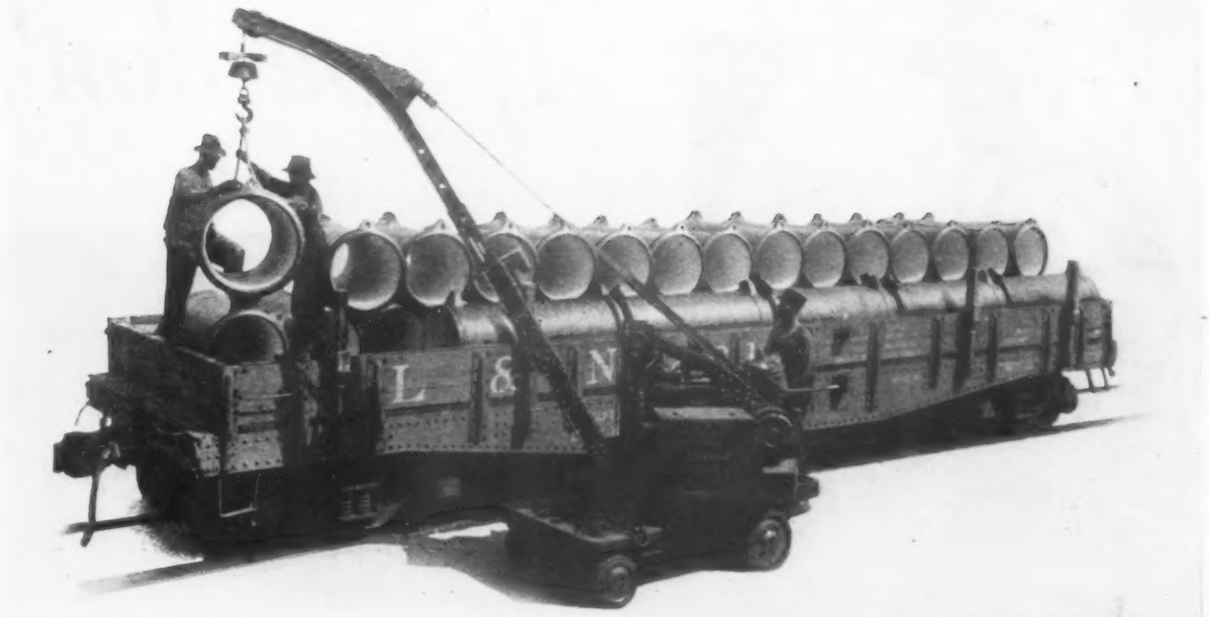


Industrial trucks are sturdy, powerful, and fast. Exide-Ironclad-equipped, they can easily do the work of many men.

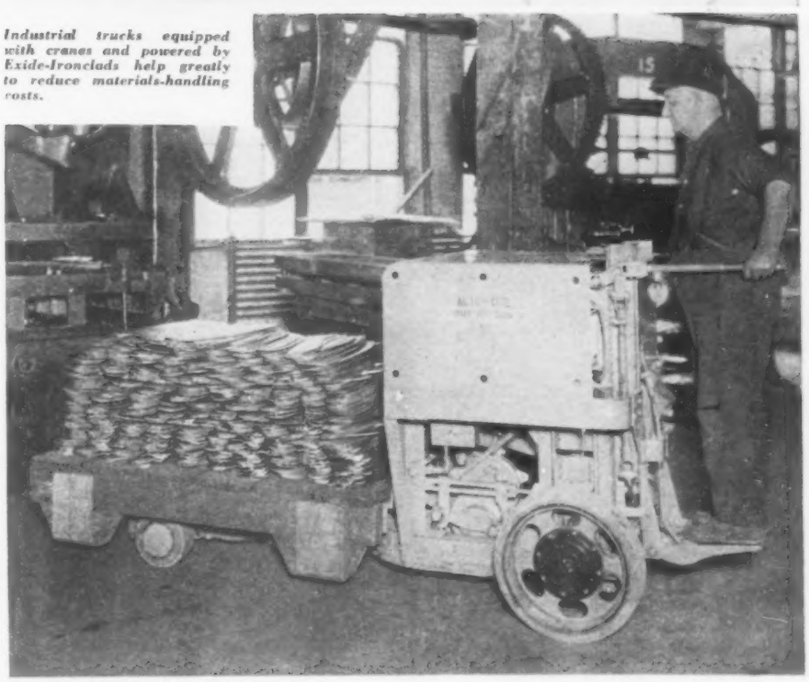
Fast-moving electric trucks and tractors save money in materials-handling . . . reduce storage costs

FIGURE storage space on the basis of productive value. Keep inventories low. Save actual dollars. Many companies are reducing materials-handling costs with fast, efficient electric industrial trucks. Stock is moved in and out quickly. Congestion is avoided. And each truck frees from one to ten men for more productive work.

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE



Industrial trucks equipped with cranes and powered by Exide-Ironclads help greatly to reduce materials-handling costs.



Electric industrial trucks speed operations, keep load off floor, and save you money

Here's how one firm Saves money

Loading cement lined cast iron pipe, 24 inches in diameter, weighing 2000 pounds per length, used to be a slow, laborious, expensive job. Now with an electric industrial crane truck, a Southern foundry company picks up six foot sections and fully loads a car in less time than it formerly took to load half a dozen sections.

You too can save money and valuable time with Exide-Ironclad-equipped electric industrial trucks. Skilled engineers have specially designed the Exide-Ironclad to furnish steady, even power under the toughest conditions of industrial truck service. Exide-Ironclads are economical at the charging panel, taking current quickly and with little waste. They maintain a consistently high voltage that gives power to make the hardest haul seem easy. And backed by 42 years' experience in building batteries for every purpose, Exide-Ironclads are designed to give years of trouble-free performance.

Write for complete details

A letter brings your copy of Booklet Form 2865. It tells you about the many uses of dependable, efficient Exide-Ironclad Batteries in different industrial truck services, and shows how savings may be effected. Write today.

Exide
IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

Exide Batteries of Canada, Limited, Toronto

If you don't



C-H ITL Control on an open hearth charging ladle

For maximum hoist earnings— control must be built "to order"



Innumerable variables must be considered when you buy a control system for your hoist. And only engineers possessing a long and varied experience can foresee all possible variables . . . can design Control which will fit the job. And it *must* fit from the *start* because "cut and try" design is impossible. C-H Engineers have had more than 30 years' intimate contact with *all* problems of hoist control . . . have an enviably successful record behind them in this field. Let C-H Engineers work with you on your next hoist installation.

let him become expert..
how can he "produce"?

EXPERT operation is operation which has become a habit. Your own time-and-motion study man will tell you *that.* But no man can operate equipment from habit if response to his master controller varies with the load; now lagging on a heavy load, now jumping on a light load.

The way to top production is to provide Motor Control which accelerates all loads uniformly in the shortest safe time . . . Motor Control which meets and overcomes the limitations of the human element . . . C-H *ITL* Control.

Assuring the acceleration of any load that can be moved, providing full protection for the motor on dangerous overloads, C-H *ITL* Control enables the operator to turn out maximum tonnage on every type of equipment.

Another striking superiority of C-H *ITL* Control is the easy way it brings equipment into motion. There is no heavy bump on the first step of acceleration . . . speed is gained on the last steps . . . as it *should* be.

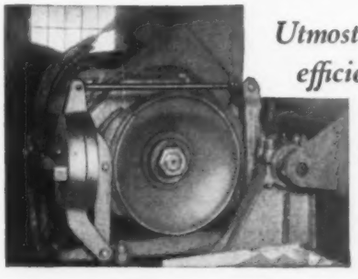


Five years of proven performance in every type of steel-mill application show that C-H *ITL* Control provides the utmost in protection, production and freedom from trouble. And simplicity of design, the absence of relays and delicate parts on the accelerating circuit assure long service at lowest maintenance costs.

A study of C-H *ITL* Control, a comparison of its advantages, easily show why leading plants have adopted this control. *Results* warrant this study and comparison. Send for the booklet "Steel Must Never Stop."

CUTLER-HAMMER, Inc.
Pioneer Manufacturers of Electric Control Apparatus
1260 St. Paul Avenue
MILWAUKEE, WISCONSIN

CUTLER HAMMER
C-H
The Control Equipment Good Electric Motors Deserve



Utmost braking efficiency in C-H Magnetic Brakes

Magnetic braking has been reduced to its simplest, most efficient terms in C-H Magnetic Brakes. The simplest, most direct design . . . absolute minimum of parts to wear and get out of order . . . braking power applied directly and in a straight line, without wastes or losses . . . rugged, durable construction . . . minimum shoe stroke, minimum braking pressure per square inch . . . these and other outstanding features make C-H Brakes the most efficient brakes . . . on every type of application.



That extra margin of power in C-H "Red Top" Magnets assures minimum metal-handling costs

In C-H "Red-Top" Magnets, every precaution has been taken against "shorts," against burnouts, against shoe breakage . . . against every factor that impairs the efficiency of a lifting magnet and pulls it out of service.

The vacuum-pressure method of coil impregnation is the best insurance against shorts and burnouts yet devised. The coil construction and coil winding permit inclusion of a greater cross section of copper . . . the one factor that makes a magnet lift. And the unusual shell design and construction result in shock-resisting strength to a degree known in no other make of magnet. And the enclosed control panel is the safest, most efficient known.

A RISING CURVE

1930



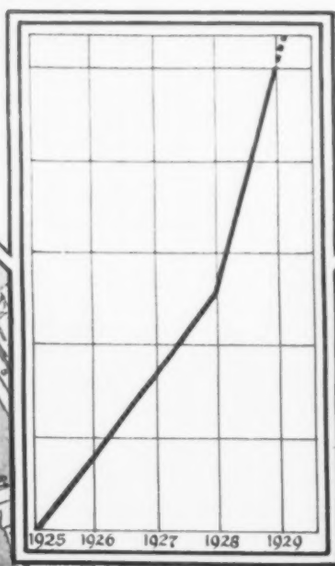
1929



Built on the strong
Composite Foundation
of
Expert Engineering
Careful Workmanship
and
Correct Business Policy.

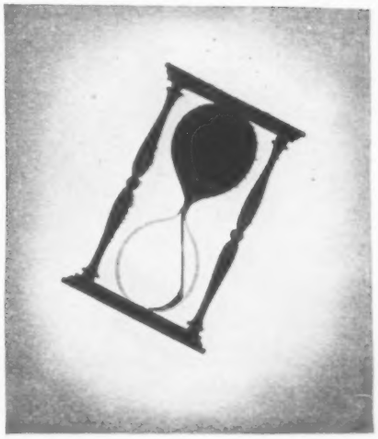
1926





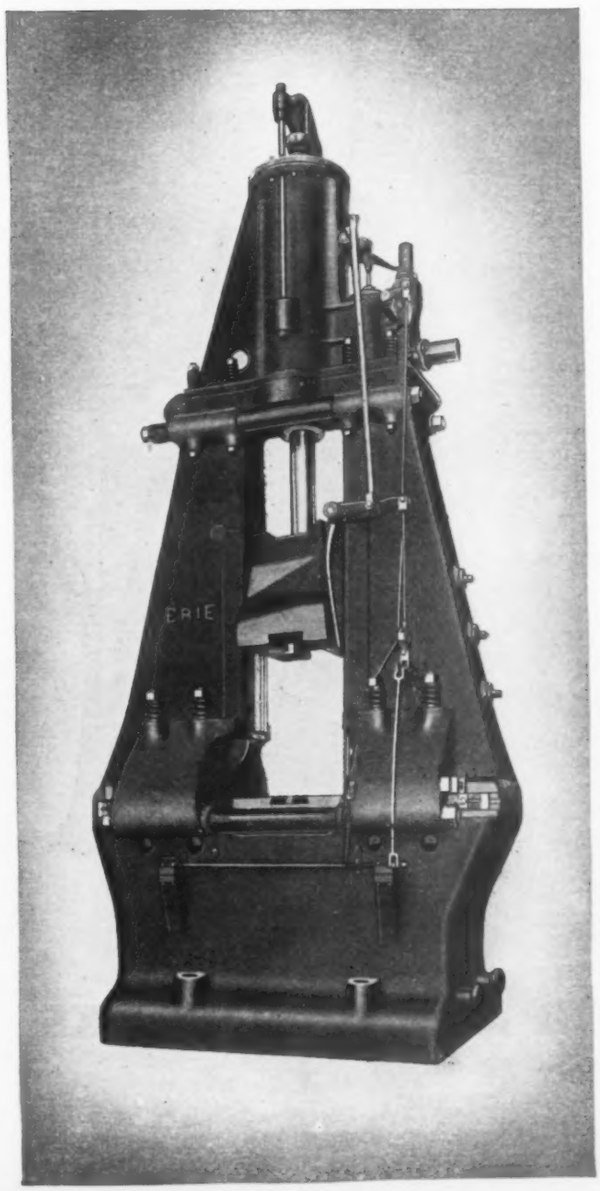
THE CLARK CONTROLLER CO.

CHICAGO CINCINNATI PHILADELPHIA NEW YORK ST. LOUIS
DETROIT PITTSBURGH CLEVELAND, O. KANSAS CITY CANTON, O.



1930

WILL IT BE A NEW YEAR



in name only?

THE beginning of a new year is for many plants the occasion for reviewing the past year's operations and considering new ideas, new equipment and new methods. The forging industry at the beginning of 1930 should be especially interested in modernizing its equipment.

A very high percentage of the forging machinery in use today is obsolete, involving excessive down time, costly repairs, lowered production and decreased profits.

Now is the time to investigate the improved Erie Board and Steam Drop Hammers and to learn exactly how much greater efficiency in operation and production are now available.

And watch for the announcement of the new Erie Direct Motor Drive Board Drop Hammer, the last word in hammer construction. Full details will be published shortly.

Let Erie Hammers help you to make 1930 a bigger and better year.

ERIE FOUNDRY COMPANY
ERIE, PA.

STEAM DROP HAMMERS BOARD DROP HAMMERS TRIMMING PRESSES SINGLE AND DOUBLE FRAME FORGING HAMMERS TOOL DRESSING HAMMERS

CHICAGO: 549 Washington Blvd.
INDIANAPOLIS: 335 Postal Station Bldg.
DETROIT: 335 Curtis Bldg.
PARIS, FRANCE: 8 Rue de Rocroy
BIRMINGHAM, ENGLAND: 174 Edmund Street

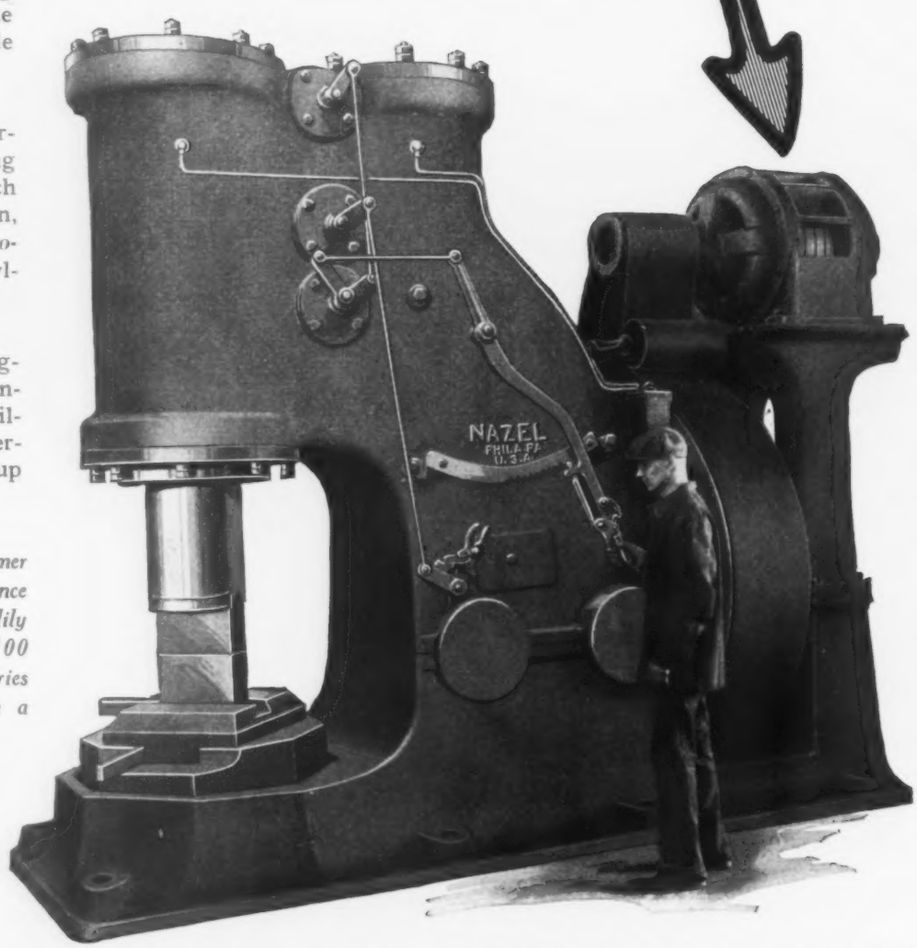
No Power Wasted
—because Motor Driven

Hammer, Compressor and Motor are a "single unit." A mere push of the thumb, starts and stops the Nazel at the operator's will,—and, therefore, power is used "only" when work is being done. This feature alone makes the Nazel a profitable investment.

Further, the Nazel "generates its own air" and, using it at the temperature which it attains in Compression, adds *high economical productivity* to its acknowledged *savings in power.*

To meet the various Forging Requirements of all Industry, the Nazel is available in 7 sizes and 3 different types, with capacities up to 10" square.

Send for the Nazel Hammer Book, and Users' Performance Surveys,—you will then readily understand why nearly 1100 concerns in 66 different industries are "Forging for Profit with a Nazel"



NAZEL ENGINEERING AND MACHINE WORKS

4045 N. Fifth Street, Philadelphia, Pa.

(—who also make The "DILL SLOTTER")



You Can't Go Wrong With

BRADLEY HAMMERS

If you could look through the window in every shop where BRADLEY HAMMERS are in operation—you would see an almost endless panorama of hammers turning out millions of pieces of work—tool dressing, drawing, forging, welding and general blacksmithing—you would see work representing every branch of industry in every part of the world.

Over one-half century of hammer-making experience is built into every BRADLEY HAMMER, and there is a BRADLEY for every purpose—a size and type that will answer your requirements. You do not have to test them to be sure they will work—they come to you thoroughly shop-tested under actual working conditions. They cost practically nothing to maintain and will last a lifetime.

Tell us your problems.

"FORGE AHEAD WITH A BRADLEY HAMMER"

C. C. Bradley & Son, Inc.

Syracuse ESTABLISHED 1832 New York



High Production Maintained

not for a day or a week, but year after year, ACME Forging Machines are on the job—machines you can depend on to maintain high production for long periods.

Designed and constructed for heavy duty, these rugged and compact machines may be run continuously at high speed or operated with intermittent motion as the work demands. There is a size and type for every purpose, equipped with motor drive either for direct or alternating current.

Write for our illustrated catalog.

THE ACME MACHINERY COMPANY

COR. ST. CLAIR AND HAMILTON STS. CLEVELAND, OHIO

DETROIT OFFICE: 5185 LORAINE ST.

EUROPEAN AGENTS: Burton, Griffiths & Co., London, England; Glaenzer & Perreaud, Paris, France; Ing. Ercole Vaghi, Milan, Italy; Henry W. Peabody & Co., Melbourne, Australia; Isbecque Todd & Co., Brussels, Belgium

The Four Big Ages

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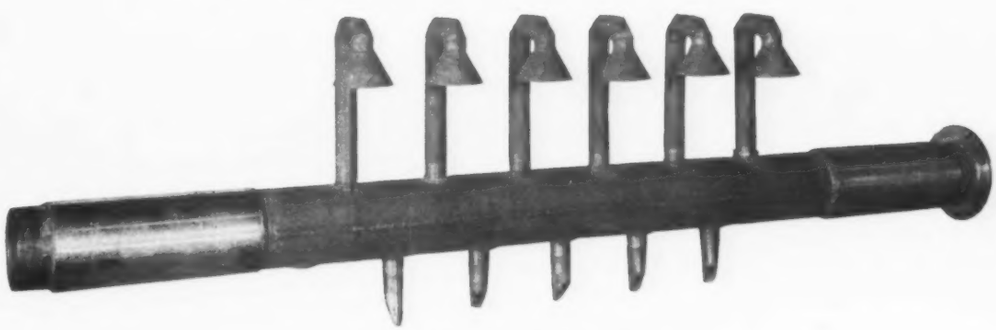
STONE AGE

IRON AGE

STEEL AGE

and now the

ALLOY STEEL AGE



Size: 15" Diameter, 20' long.
This manifold fabricated from 18% Chrome, 8% Nickel, Alloy Steel sheets, formed, welded and machined.

You know what the word "Fabrication" means when talking about Standard Steel—but— how about "ALLOY STEEL?"

WE FABRICATE ALL KINDS OF ALLOY STEELS

When in difficulties in fabricating alloy steels, call on us.

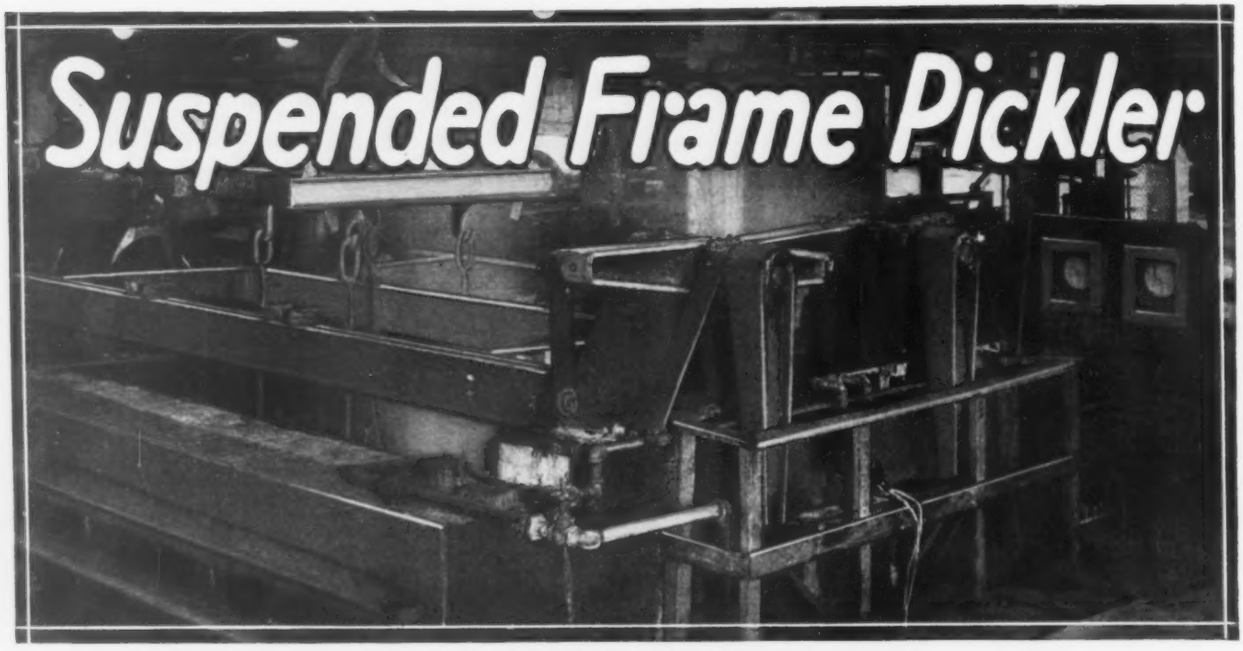
18% Chrome, 8% Nickel
12% to 16% Chrome
16% to 20% Chrome
26% to 30% Chrome
25% Chrome, 13% Nickel

PITTSBURGH PRODUCERS SUPPLY CO.

Welding Engineers and Manufacturers in Steel and Alloy Steel

METROPOLITAN ST. PITTSBURGH, PA.

COLUMBUS, OHIO OFFICE—THE ROSS-WILLOUGHBY CO.



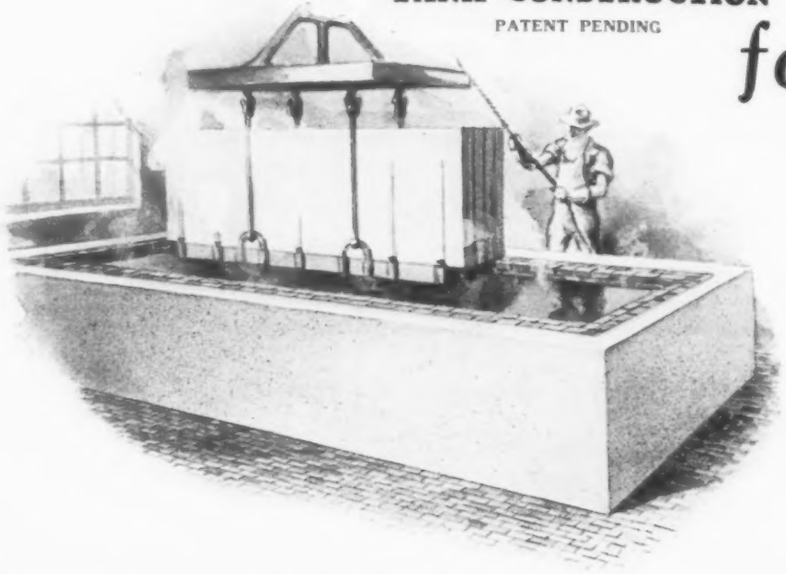
PATENT NO. 1722001

EFFICIENT and DURABLE The above illustration shows one of our Suspended Frame Picklers installed in the plant of a large sheet steel company. Designed for rigidity and durability they give unusually long service with a decided saving in labor charges. They can be combined with our BASOLIT Constructed Pickling Tanks to give permanent, trouble-free installations. Full particulars upon request.

BASOLIT

TANK CONSTRUCTION

PATENT PENDING



for **PICKLING, PLATING & STORAGE TANKS - - -**

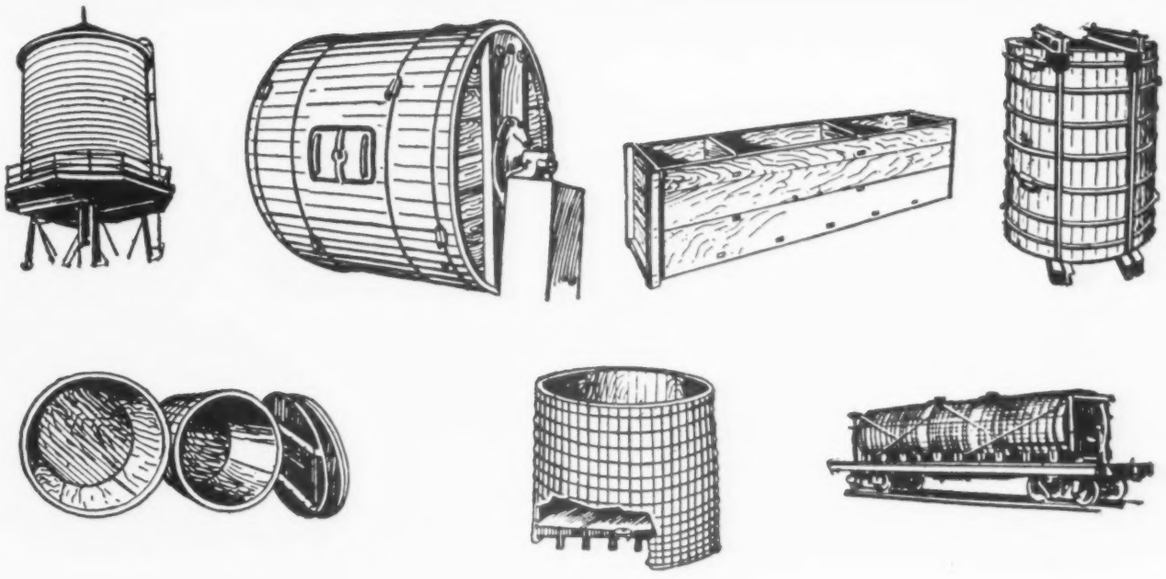
BASOLIT positively stops the leakage in Pickling, Plating and Storage Tanks, rendering them free from wear, tear and deterioration.

We will furnish detailed Specifications, Drawings and Instructions on any Acid Proof Tank Proposition. Write for information and prices.

New York Office
302 Singer Bldg.

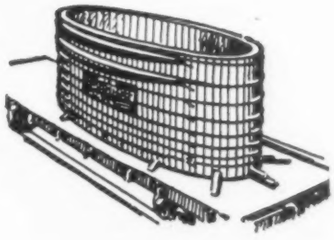
NUKEM PRODUCTS CORPORATION
70 NIAGARA ST. BUFFALO, N. Y.

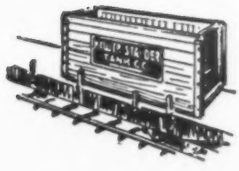
Pittsburgh Office
604 Chamber of Commerce Bldg.

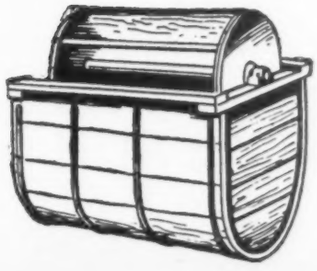


In the Forest the Manufacture of Hauser-Stander Tanks Begins









From the time the timber is standing in the forest, to the time a Hauser-Stander Tank is erected in your or our shop—every operation, every phase of manufacture, every piece of material, is under the strict supervision of The Hauser-Stander Tank Company.

This method of manufacture results in the finest wood tank it is humanly possible to produce, as any of our customers will attest. It also produces results in economies that make Hauser-Stander Tanks outstanding in value.

If you use heavy pickling, acid storage, or special duty tanks, get in touch with us. We have the experience, the men and the facilities to take care of practically every tank requirement.

Our catalog will prove to be very interesting, write for it.

"We Win With Quality"

The Hauser-Stander Tank Co.

Cincinnati, Ohio, U. S. A.



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AIRTIGHT STEEL TANK COMPANY
PITTSBURGH, PENNA.



TANKS FOR: High pressure gas and air storage—Pneumatic water systems—Gasoline and oil storage—Oil burning equipment—Open top—Welded. ASTCO Genuine Copper Brazed Tanks for high pressure—the tightest, safest, strongest tank it is possible to construct by any known process.—ASME code tanks.



COLE TANKS
STANDPIPES -:- PLATE WORK
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NEWNAN Est. 1854 GA.

SCAIFE COPPER-BRAZED TANKS
for Air, Gas and Liquids
Welded Tanks Riveted Tanks Rivet Weld Tanks

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(128 years old—Founded 1802)
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Storage, Galvanizing, Pickling and other WOOD TANKS, 4" to 8" in thickness, any length, acid resisting rods when specified.

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"JASCO" TANKS
TANKS FOR GASOLINE — OIL — AIR — ETC.
COMPRESSED GAS CYLINDERS
—JOS. A. JANNEY, Jr.—
Successor to
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In addition to railroad tanks we build flat-bottom storage tanks, elevated tanks, Wiggins roofs and steel plate work.
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We make Tanks (both riveted and welded), stacks and structural work. Aluminum tanks, kettles and trucks are among our specialties. Send for folder and other information.

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Steel Plate Construction
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ANNEALING BOXES, STACKS, ELEVATED TANKS, TANK CARS AND WELDED BOXES, BINS, OR KETTLES—GENERAL STEEL PLATE CONSTRUCTION.
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Fabricators and erectors of self-supporting Steel Stacks, Breechings, Piping, Tanks, Chutes, Bins, etc., riveted or welded, for Blast Furnaces, Steel and Power Plants and other Industries.
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CHARLES PAGE PERIN, STEWART M. MARSHALL, FRANK L. ESTEP

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New York City, 11 West Forty-Second Street

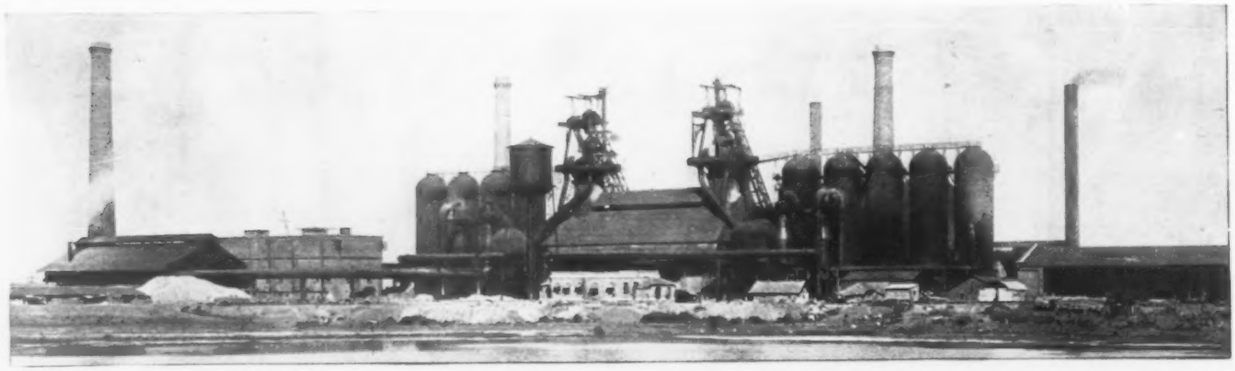
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Investigations—Reports—Designs

Raw Materials to Finished Products

McKee World-Wide Service



Complete Blast Furnace Plant in India, designed and constructed by Arthur G. McKee & Co.

COMPLETE BLAST FURNACE PLANTS AND STEEL PLANTS

Over **Ninety-Five Per Cent** *of all the principal iron and steel companies of the United States and Canada and many foreign companies in Belgium, France, Russia, China, Japan, and Australia have been served by Arthur G. McKee & Co. during the past quarter of a century.*

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Improved Design, Including Mauthe Roller Type, Worm Drive and Selective Control

Blast Furnace Stock Houses . . .
McKee Type Suspension Bins, Less Steel per Ton of Capacity, Continuous Segmental Gates, No Intermediate Diaphragm Plates, Low First Cost, No Operating or Maintenance Cost

Majority of Recent Blast Furnace Stock House Installations Have Been of this Type

Hot Blast Stoves . . .
Highly Efficient Small Checker Stoves, with "Nested Tile" Checkers, Temperature Resisting Metal Supports for the Checkers assuring Full Area Exit of the Gases from all Checkers and Large Heating Surface Area for Any Given Size of Stove

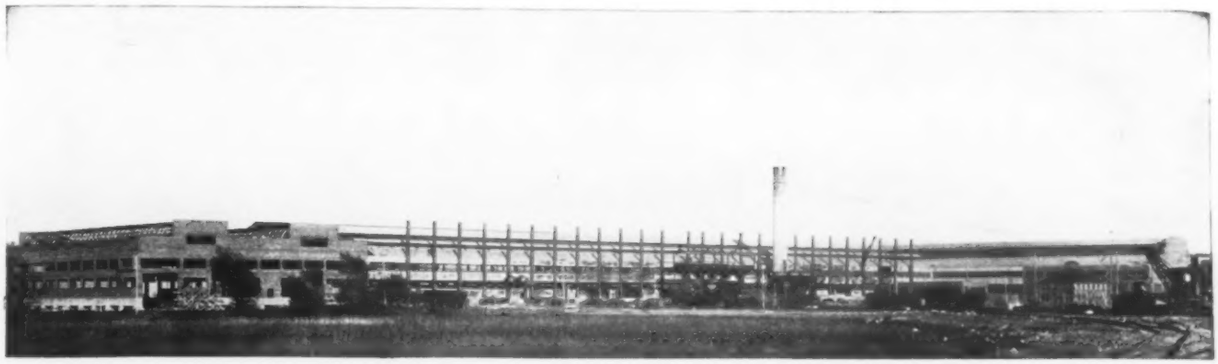
McKee Gas Washers . . .
Low First Cost, Low Water Consumption, Dry Clean Gas, Adaptable to Existing Tower Washers

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Rugged Construction, Low Maintenance Cost, Large Capacity with Relatively Small Head Room, Amply Powered for Fast and Efficient Service

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Sheet Steel Mill designed and constructed in 1929 by Arthur G. McKee & Company

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Arranged to Charge by Volume or by Weight
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Design and Construction of Complete Plants for Cleaning, Storing, Mixing and Burning of Blast Furnace or mixed Blast Furnace and Coke Oven Gases.

The only complete plant of this type in America for Open Hearth Furnaces and Steel Mills designed and built by McKee

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COTTRELL

ELECTRICAL PRECIPITATION PROCESSES

for the removal of

DUSTS, FUMES, MISTS, TARS

and OTHER SUSPENDED MATTER from GASES

The following applications of the Cottrell Processes are established by satisfactory performance and the removals effected being only dependent on the Purchasers' requirements.

By-Product Coke Oven Gas	95%—99%	removal
Powdered Coal Ash	90%—95%	"
Hot Roaster Gas	95%—99%	"
Sulphuric Acid Mist	95%—99%	"
Contact Acid Gas Purification	99%	"
Phosphoric Acid Recovery	95%—99%	"
Carburetted Water Gas	95%—99%	"
Carbon and Lamp Black	95%—99%	"
Miscellaneous Applications	90%—99%	"

Our experience gained through the construction and successful operation of Cottrell Electrical Precipitation Process Installations of a total gas capacity exceeding 10,000,000 cubic feet per minute treating different types of gases enables us to intelligently study any new problem in gas cleaning. If our Process can be adapted, we are prepared to offer a complete installation guaranteed to effect the desired result.

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Blast Furnace Gas Cleaning
Powdered Fuel Ash Removal
Carbon and Lamp Black Recovery
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Non-Ferrous Metal Treatments

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NEW YORK, N. Y.

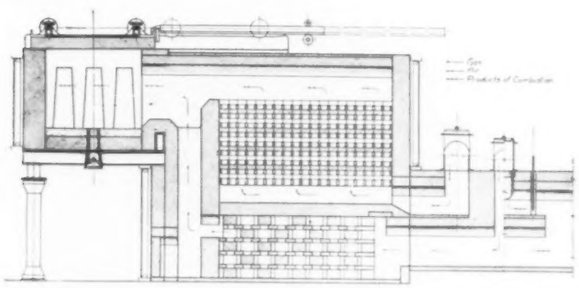
Chicago Office, 343 S. Dearborn Street
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Air Cleaning
Food Products Recovery
Paper & Pulp Mill Processes
Sulphuric Acid Recovery
Roaster Gas Cleaning
Miscellaneous Acid Recovery

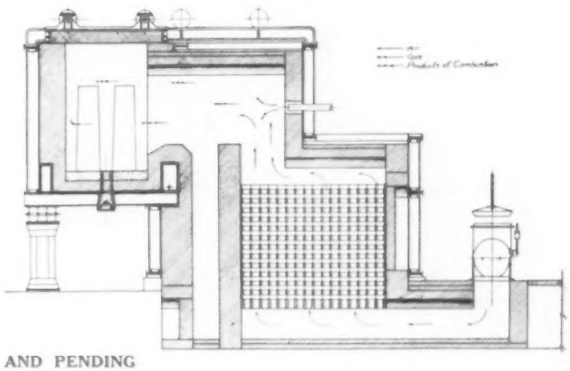
SINGLE REGENERATIVE SOAKING PIT

EACH HEATING CHAMBER IS A COMPLETE FURNACE

For
Producer Gas, Natural Gas, Coke Oven Gas or Oil



For
Blast Furnace Gas



PATENTS ALLOWED AND PENDING

The Outstanding Feature of This Unit Is Its Flexibility

One or any number of Heating Chambers can be added at any time.

Four of these Single Regenerative Soaking Pit Furnaces occupy less floor space than a separate control Four Hole Regenerative Soaking Pit Furnace.

Preheating Chambers can be added at any time and preheating done by use of split flame.

One Heating Chamber may be repaired or entirely rebuilt without in any way affecting another Heating Chamber.

GEORGE NAISMITH & SON

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Established 1897

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Mechanical and Hand-poked Gas Producers, Steel Stacks, Tanks, Rotary Dryers, Calciners, Steel Riveted Pipe and Steel Plate Construction.

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ARTHUR L. STEVENS CORPORATION
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205 WEST WACKER DRIVE, CHICAGO, ILLINOIS
Open Hearth Furnaces, Soaking Pits.
Continuous and Regenerative Heating Furnaces.

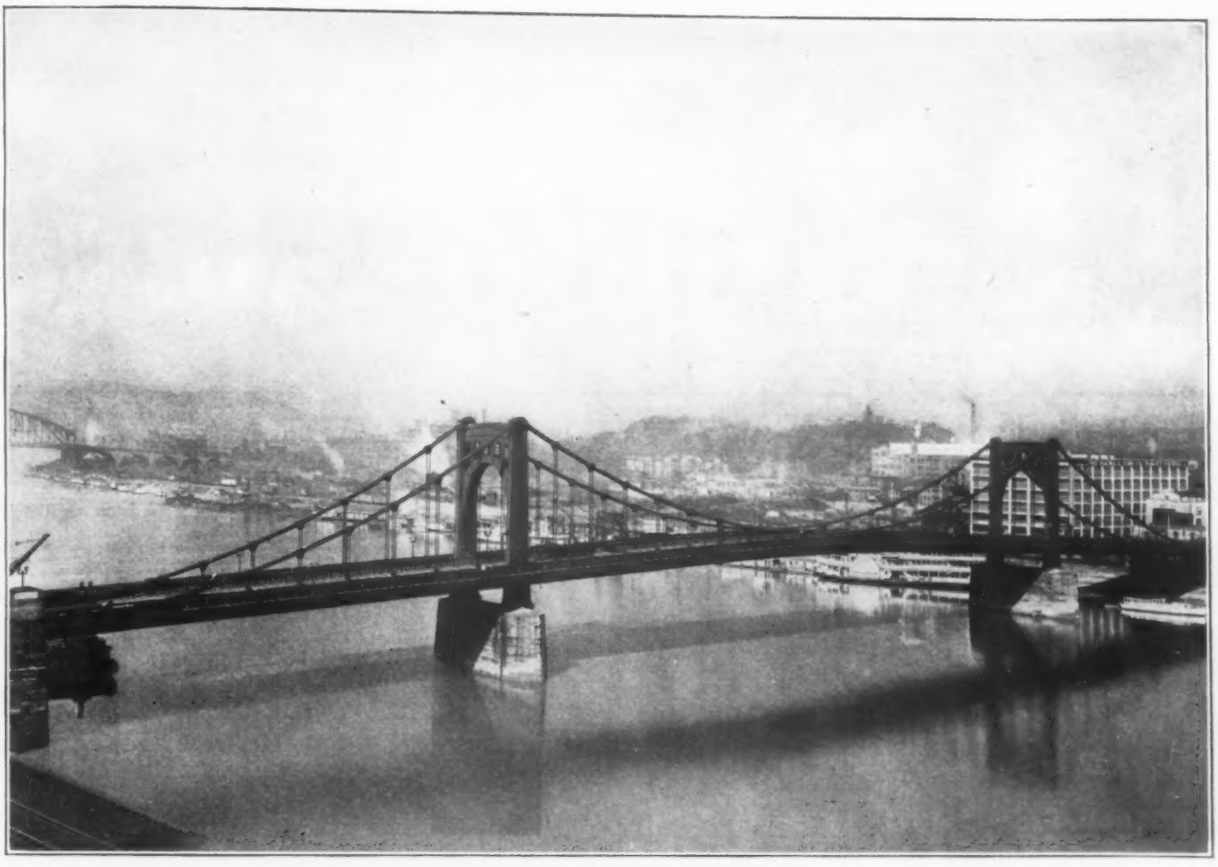


Illustration: The SIXTH STREET BRIDGE over Allegheny River at Pittsburgh, Pa., selected by a national jury appointed by AMERICAN INSTITUTE OF STEEL CONSTRUCTION as the most beautiful bridge completed in 1928.

The STRUCTURAL STEEL in the superstructure of this bridge was produced by Carnegie Steel Company, and FABRICATED and ERECTED by

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Subsidiary of United States Steel Corporation

General Offices: 71 Broadway, New York, N. Y.

Contracting offices in New York, Boston, Philadelphia, Baltimore, Pittsburgh, Cincinnati, Cleveland, Detroit, Chicago, St. Louis, Minneapolis, Duluth, Salt Lake City and Denver.

Manufacturers of Steel Structures of all classes particularly - - -

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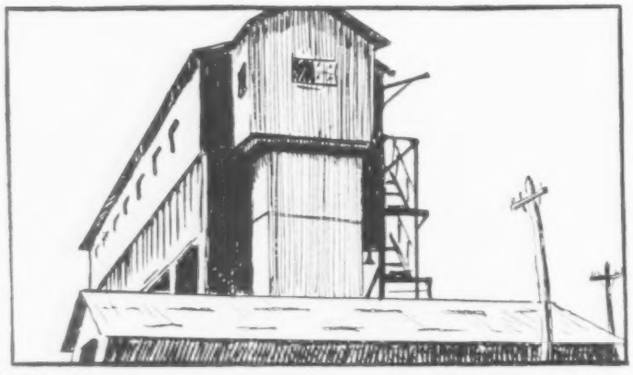
Pacific Coast Distributor:

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Where Manufacturers Conserve with ARMCO Ingot Iron

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Dryers, Industrial
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Heaters, Unit
Mine Cars
Pipe, Gas
Pipe, Irrigation
Pipe, Oil
Pipe, Stand
Pipe, Stuff
Pipe, Water
Radiators, Automobile
Railroad Cars
Roofing and Siding
Scale Housings
Screens, Well
Stacks, Smoke
Switch Boxes
Tanks, Automobile Radiator
Tanks, Brine
Tanks, Expansion
Tanks, Oil
Tanks, Gas
Tanks, Truck
Tanks, Water
Tubes, Boiler
Vats
Well Casings
Wire, Telephone
Wire, Telegraph
Wire, Welding

ARMCO

Back of this familiar trade symbol is nearly thirty years experience in making special analysis iron and steel sheets and plates. When you need a rust-resisting, low-cost metal be sure to see this triangle and the words, "ARMCO Ingot Iron." It is your assurance of adequate and dependable service.

ARMCO INGOT IRON

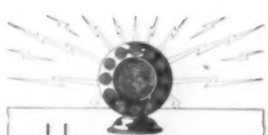
bring low-cost fabrication and maintenance

WHETHER you estimate sheet and plate values in terms of economical fabrication or low-cost maintenance, there are savings for you when you use ARMCO Ingot Iron.

This uniform pure iron shapes easily and surely. It welds rapidly; and every weld is smooth, dense, and strong. These qualities are consistent, too. They are inherent with every sheet and plate.

Rust-resistance, durability, you'll find in ample measure. ARMCO Ingot Iron is time-tested and proved. It has the *longest record of actual service* of any low-cost, rust-resisting sheets and plates.

An ARMCO Development Engineer will be glad to help you with your particular problem. Many users have been shown how to get full value out of their metal investment. Just call on the office nearest you.



Hear the famous
ARMCO CONCERT BAND
every Tuesday night
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Ten to eleven E.S.T.

The American Rolling Mill Company

Executive Offices, Middletown, Ohio

Export: The ARMCO International Corporation

DISTRICT OFFICES: Chicago, Cincinnati, Cleveland, Detroit, New York, Pittsburgh, Philadelphia, St. Louis, San Francisco

You can now get "Rejection Insurance"

YOUR MILL LOSSES, chipping costs and rejections are the index of how nearly correct is the design of your ingots.

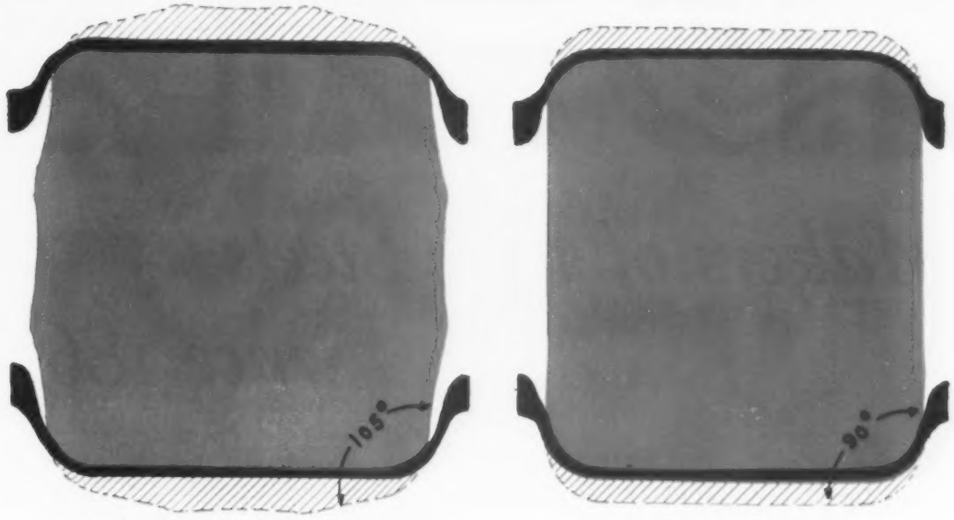
A number of plants have purchased "rejection insurance" for 1930 through the adoption of the new Gathmann rectangular corrugated contour throughout their ingot production. It is to your advantage to investigate its possibilities in your practice.



This design for surface improvement is establishing a new high standard of quality in big-end-down practice. If you have not read our booklet describing its advantages, write for a copy.

This Booklet sent upon request.

THE GATHMANN CONTOUR
for Surface Improvement is covered by
U. S. and Foreign Patents.



First Pass Gathmann Ingot
Corner Reduction Light

First Pass old type Ingot
Corner Reduction Heavy

Initial Reduction Pass Indicates Surface Condition of the Finished Bloom

It will be clear to the engineer from a study of the above contours why the new Gathmann ingot cross section solidifies and rolls to such advantage.

In solidification the skin of the ingot is flexible and the entire mass is free to contract without danger of the skin breaking.

In rolling of the ingots, the relatively narrow primary sides are swedged outwardly to a large extent parallel with the axis of the rolls rather than stretched or flowed longitudinally. The free, unworked adjacent sides are thus deformed only slightly, if at all, during the initial pass in the rolls.

Give us an opportunity to discuss your ingot designs and rolling mill problems. Our recommendations are entirely without obligation.

The
GATHMANN ENGINEERING CO.
"Designers of Ingot Molds"

BALTIMORE, MARYLAND

MIDVALE

Makers of Fine Steels ...Since 1867

THE close of the year of 1929 marked the sixty-second year that the Midvale works has manufactured fine steel products. From a small crucible melting shop, the facilities of our Company have expanded until today they include a very wide range of equipment for manufacturing high-grade steels . . . open hearth and electric melting furnaces, iron and steel foundries, rolling mills, forge shops for heavy, medium and small size forgings, heat treatment plants and eight modern machine shops . . . all supplemented by scientific research and laboratory control.

Some notable performance records marked the past year . . . cable saddles were made for the new Hudson River suspension bridge, a million and a half pounds, constituting the largest single shipment of machined steel castings ever made from a Philadelphia plant; a generator shaft made from a 469,000 pound ingot, was forged, treated and machined; we have continued on a large scale the manufacture of forged steel boiler drums and other large high pressure vessels of both carbon and alloy steels.



The acquisition of the Chrome Alloy Products, Inc., by Midvale marks our definite entry into the field of high-grade chrome and chrome-nickel castings. We are in an exceptionally good position to assist in problems of construction which demand materials resistant to heat and corrosion.

Thus Midvale is better equipped than ever to meet the ferrous metal needs of industry.

★

THE MIDVALE COMPANY

NICETOWN, PHILADELPHIA

NEW YORK CLEVELAND WASHINGTON CHICAGO PITTSBURGH SAN FRANCISCO

To Midvale's Friends . . .

Cordial Greetings and Very
Best Wishes for the . . .

New Year 1930





SPECIAL HIGH GRADE FORGING BILLETS

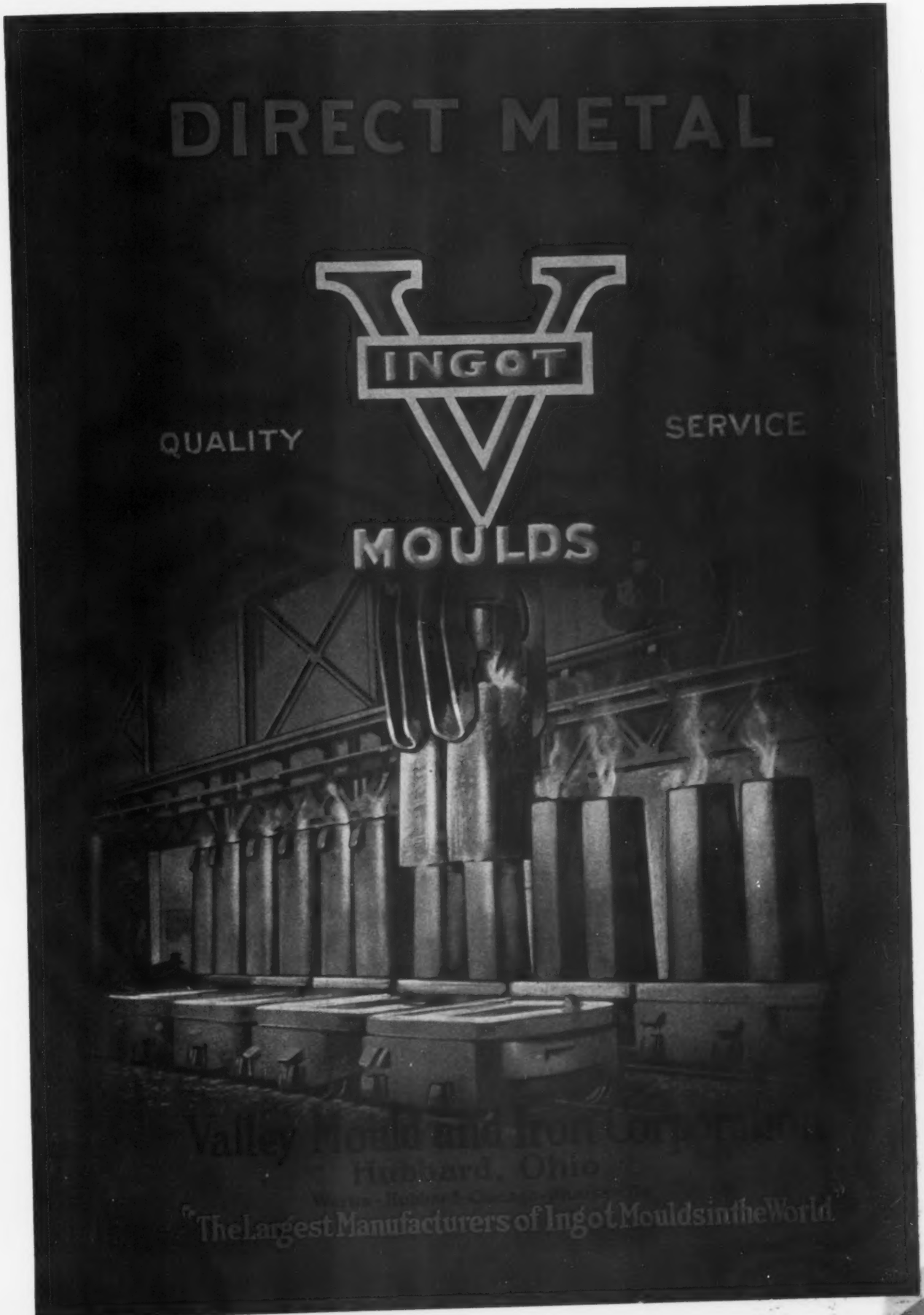
The extreme care taken in the inspection and chipping of ASCO Special High Grade Forging Billets assures clean forging surface, free from seams, slivers and surface defects.

Beyond that the ASCO trade-mark stands as the symbol of quality and service backed by a mill equipped to produce billets in carbon and alloy steel to meet the most exacting demands of discriminating buyers —a few of the factors responsible for the increased demand for ASCO Special High Grade Forging Billets.

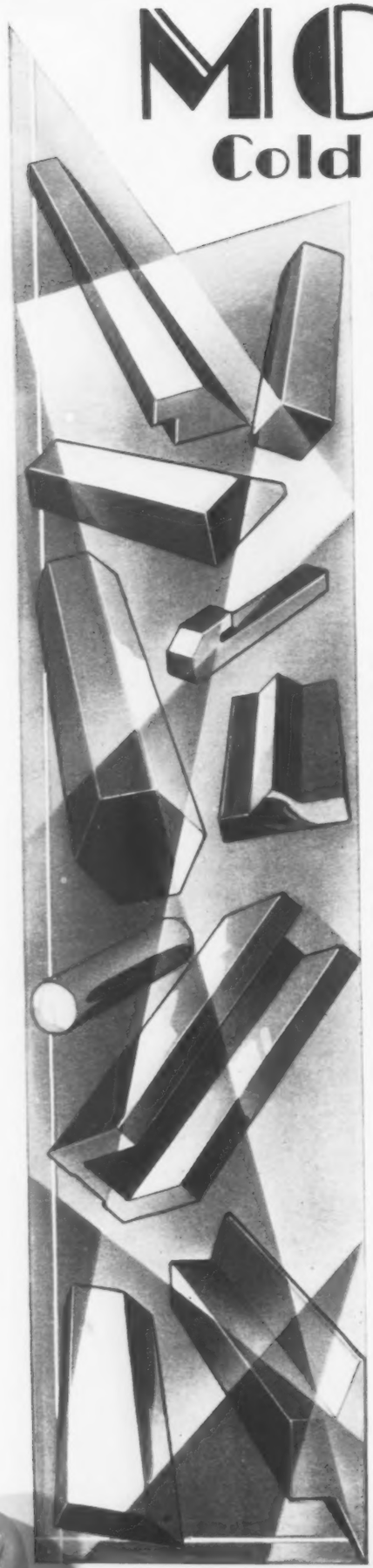
Write today for our Forging Billet Stock List containing a complete list of sizes of varied analyses carried for immediate shipment—a service feature distinctly individual in its wide scope.

THE ANDREWS STEEL COMPANY

NEWPORT KENTUCKY


DIRECT METAL
INGOT
QUALITY
SERVICE
MOULDS
Valley
Hubbard, Ohio
"The Largest Manufacturers of Ingot Moulds in the World"

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We manufacture a complete line of Cold Drawn products—

Cold Drawn Steel Shafting, Screw Stock and Special Polished Rods; Manufacturing Rounds, Squares, Hexagons, Flats, and Special Shapes. Turned and Polished Shafting. Machine Keys, Woodruff Keys, Taper Pins and Machine Rack. Flattened Steel Plates for practically any use.

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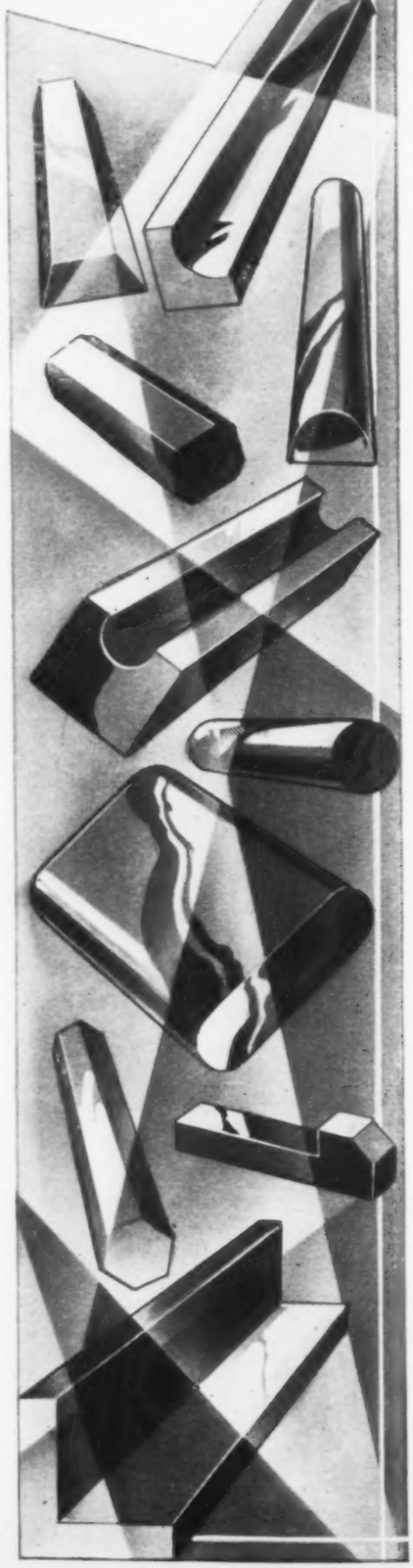
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Have you a difficult cold-forming operation?

"We have obtained unusual results in increasing both the tensile strength and the wearing qualities of our product."

THIS is the statement of a prominent chain manufacturer in regard to their adoption of Carnegie Carbon Manganese Chain Steel. It is typical of the results obtained by the many concerns who are solving their production problems on a quality basis by the use of this steel. The single link illustrated shows one extremely difficult cold forming operation that can be accomplished.

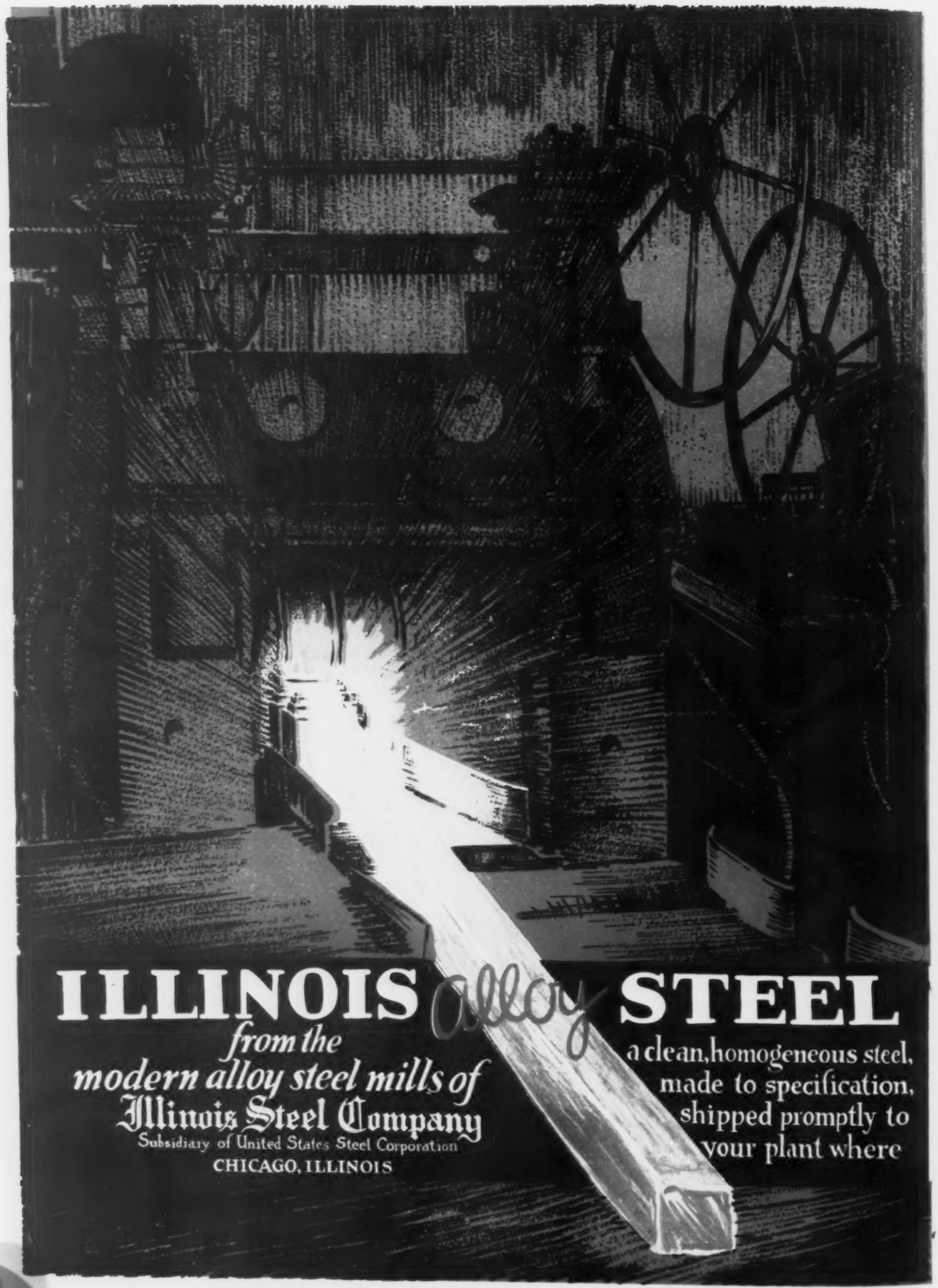
Carnegie Carbon Manganese Steels are supplied, hot rolled, in a number of grades, suitable for different purposes. The grade for threading or other high speed cutting is a low carbon, high manganese, high sulphur steel that is tough, easily machined, forged and heat treated. A special grade for forging responds to heat treatment in a manner similar to the more expensive alloy steels, such as 3½% nickel and low nickel chrome steels . . . .

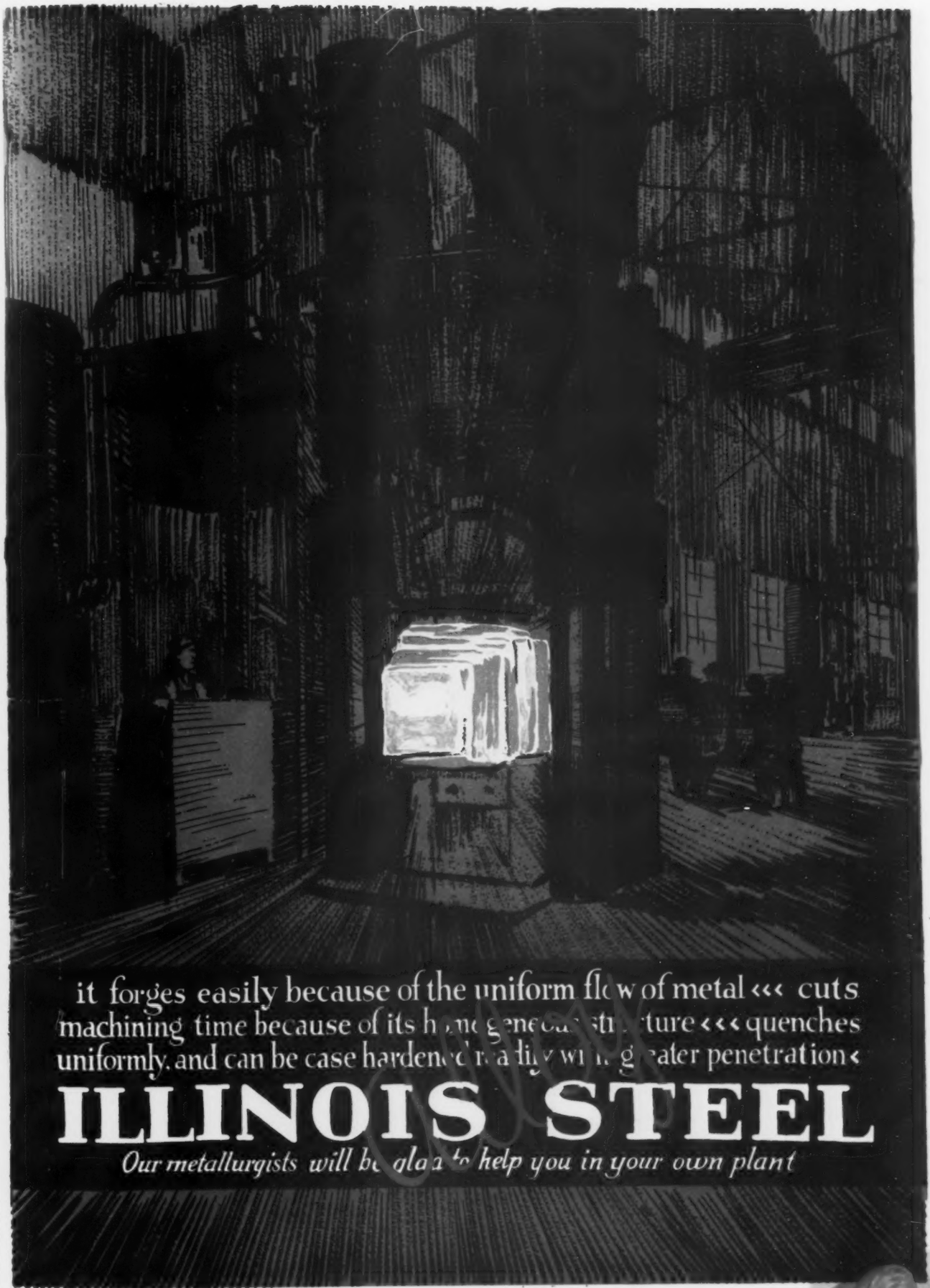
Our technical representatives are always at your service and will gladly cooperate with you on any problems involving your steel requirements . . .

CARNEGIE STEEL COMPANY
Subsidiary of United States Steel Corporation
PITTSBURGH, PA.

47

CARNEGIE
CARBON MANGANESE STEELS


ILLINOIS alloy STEEL
from the
modern alloy steel mills of
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Subsidiary of United States Steel Corporation
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a clean, homogeneous steel,
made to specification,
shipped promptly to
your plant where


it forges easily because of the uniform flow of metal ‹‹‹ cuts
machining time because of its h[illegible] g[illegible] st[illegible]ture ‹‹‹ quenches
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ILLINOIS STEEL
Our metallurgists will be glad to help you in your own plant

There are some instances one institution has become a the products of an entire industry are measured.



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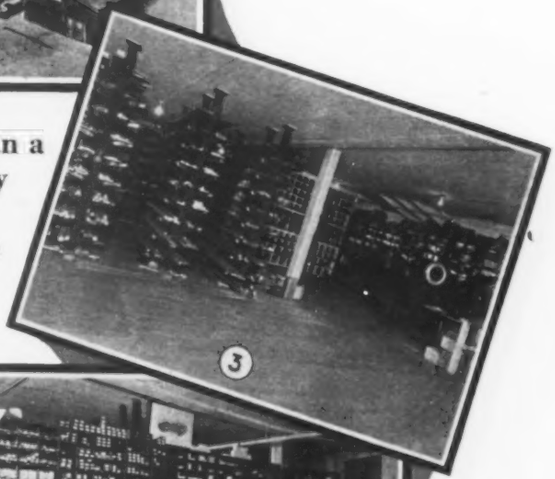
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A BUSINESS reminder that should be jotted down on the memo-pad of every eastern steel user, is the fact that B & L cold drawn steels and turned shafting can now be ordered direct from Buffalo.

The new plant of Bliss & Laughlin, with its superior production and shipping facilities, insures prompt deliveries on your orders for rounds, squares, flats and hexagons—a timely service that protects your schedules—a constant high quality that raises the standard of your products.

A shipment overnight, if you are within reasonable distance, or but a few hours more to remote points, that is what you can expect when you are located at any point within the *service radius* of the new B & L plant. Bliss & Laughlin's fine record in the Chicago district is now being daily duplicated in the Buffalo district.

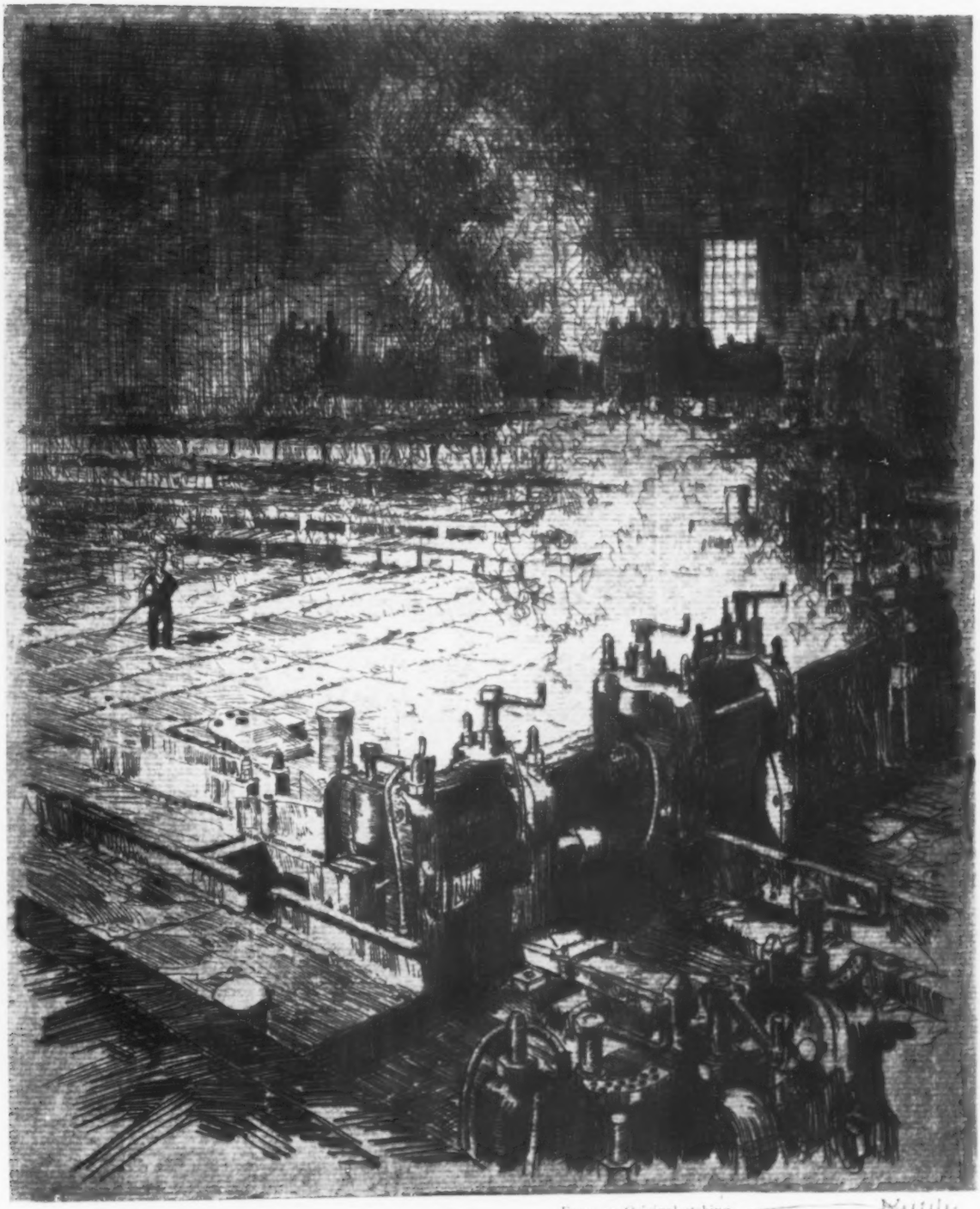
Pass the good news along to your purchasing department, so that your next order for bar shapes or turned shafts may come through with B & L certainty and satisfaction. Inquiries solicited.

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WGL 7598



From an Original etching

MERCHANT MILL
IN THE TIMKEN STEEL PLANT



A Practical Suggestion from Another Steel User



As one steel user to another, let it be understood that quality means much—if it fits the need.

After thirty years of experience in using fine alloy steels, Timken states that the proper selection of steel is the basis of successful use.

With this thought uppermost, Timken developed a service to other fine steel users—and evolved a policy to match it. "Good Will based on Good Steel" is the promise Timken makes that unmatched satisfaction must follow the use of Timken Steels.



This simply means that Timken co-operates to fit Timken quality and volume to the individual need, to the end that some one Timken Steel will serve with greatest economy and endurance.

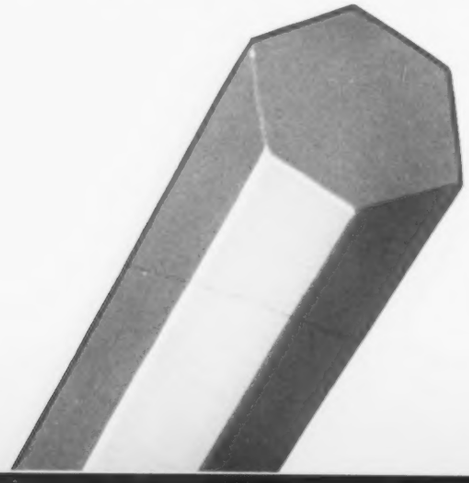
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ALLOY STEELS

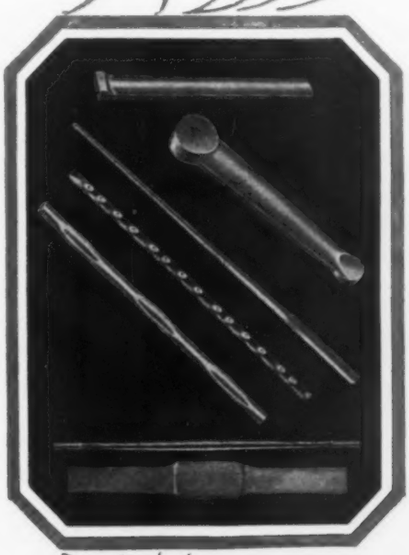


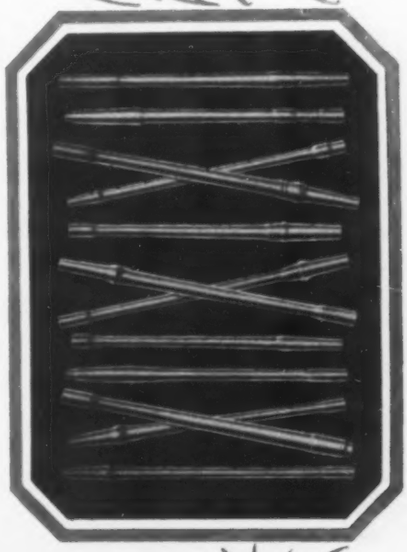
Have you investigated the possibilities of **die-rolling** *your product*

SO many different products are today being successfully produced by the Witherow Continuous Die Rolling Process that you owe it to yourself to investigate this remarkable method as it applies to your product.

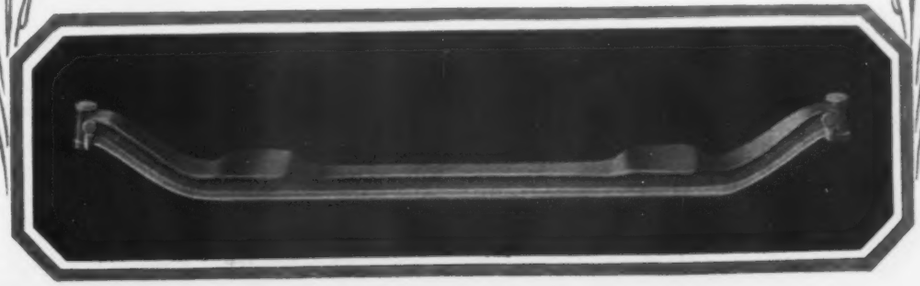
More uniform grain structure—greater strength—faster and more dependable production—and at lower cost—are typical of the many advantages other manufacturers are today enjoying through the use of the continuous die rolling process. Why not let our engineers make a study of your product and submit their recommendation? No obligation of course.

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PITTSBURGH, PA.





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Important Points Regarding the Use of Rustless Iron

In considering the adoption of Rustless Iron, the following facts are of great importance:

1 Parts might be designed in lighter gauge when Rustless Iron shall be used. The comparative physical properties show it to be superior to other corrosion resistant metals.

2 The specific gravity of Rustless Iron is exceptionally low. There are more square feet of a certain gauge to the pound of Rustless Iron than of many other metals.

3 The manufacturing cost of Rustless Iron articles is usually lower than the cost of producing the same articles from other corrosion resistant metals. In many cases Rustless Iron has replaced plated non-ferrous metals with a considerable saving in equipment and labor cost.

Our development division, which is composed of a staff of men who have had many years experience in the manufacture of chrome iron alloys, will work out applications, will furnish comparative costs, and give suggestions for equipment and tool design upon request.

RUSTLESS IRON CORPORATION OF AMERICA

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Baltimore, Maryland

Detroit
2100 Fisher Bldg.

Pittsburgh
Grant Bldg.

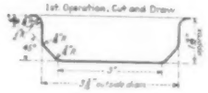
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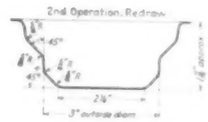
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DEFI RUST HEAT ACID STAIN

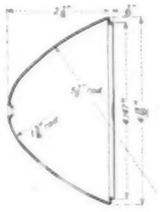
RUSTLESS IRON

Deep Drawing









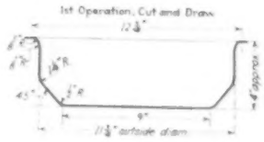
THE technique of deep drawing Chrome Iron Alloys containing high percentages of Chromium is quite different from the present practice of drawing steel, copper, brass or other metals. Judging by the physical properties as found in standard tensile tests such alloys seem to be very similar to certain ordinary steels. Their behavior in deep drawing is not alike, however, due to certain special features with which these Chrome Iron Alloys confront us and which unfortunately are not generally known by the design engineers in the plant. There is no literature available on this subject and the lack of a reliable drawability test makes it still more difficult.

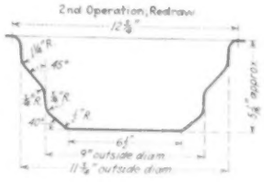
It is necessary to avoid overstraining these alloys in any forming operation, especially if further deformation takes place in following operations. In carefully calculating the different steps, material with up to 20% Chromium content can be drawn into any shape with oftentimes less breakage than other materials.

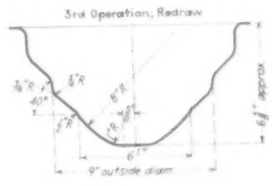
The tool steel has to be properly selected, and oil hardening alloy steels should be used where mass production is desired. This will eliminate frequent refinishing of the dies. Cast iron works also satisfactorily and in some cases very excellent results have been obtained with bronze dies.

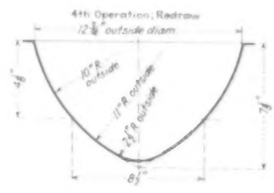
The lubrication is of greatest importance and will be dealt with in an early issue.

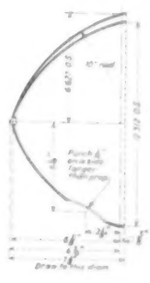
The drawings show the dimensions of actual layouts which are made by the development division of the Rustless Iron Corporation of America.











RUSTLESS IRON CORPORATION OF AMERICA

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"Imperial Major" Wins Again!

Beats Super High Speed Steel

7 to 1

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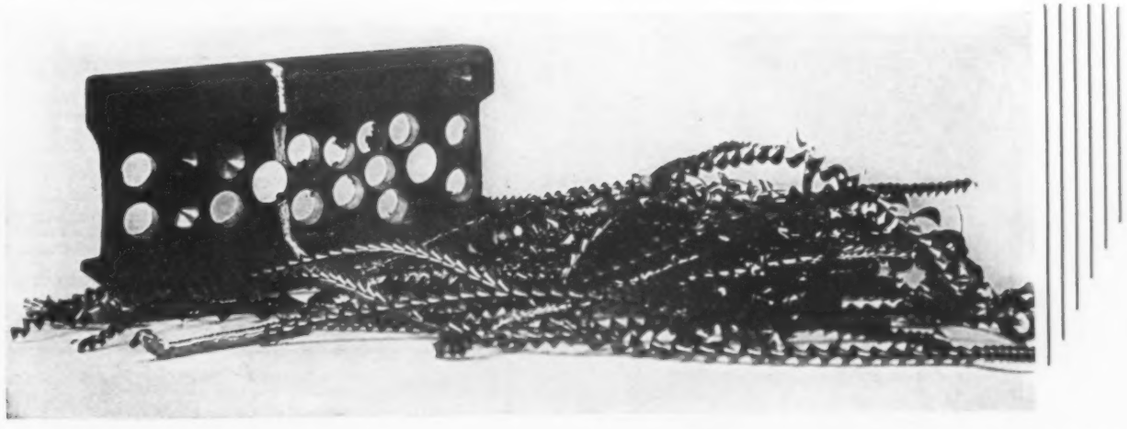
On a very recent test, conducted under actual working conditions by unbiased authorities, a drill made of "Imperial Major" drilled 3500 holes in cast iron as against 500 holes for super high speed steel and 100 holes for regular high speed steel.

Nor is this freak performance, either! If you want all the facts concerning the test, we'll be glad to send them to you.

Ever since "Imperial Major" has been introduced to the trade, it has been making and breaking production records on all classes of work—INCLUDING THE DRILLING OF MANGANESE STEEL AND OTHER HARD-TO-DRILL ALLOYS.

You're missing something if you don't get the facts on this high frequency electric furnace product—"Imperial Major."

This illustration shows holes drilled through the web of a rolled manganese steel rail of 11½-13% manganese content with a drill made of "Imperial Major." The speed of the drill was 27 feet per minute and the feed .007". The same feeds and speeds were used on drilling *cast* rails of the same manganese content.



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741 Washington St.

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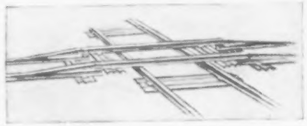
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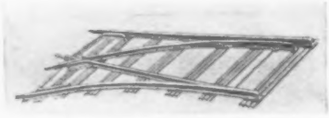
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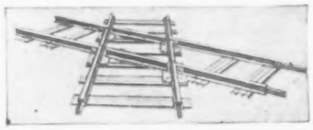
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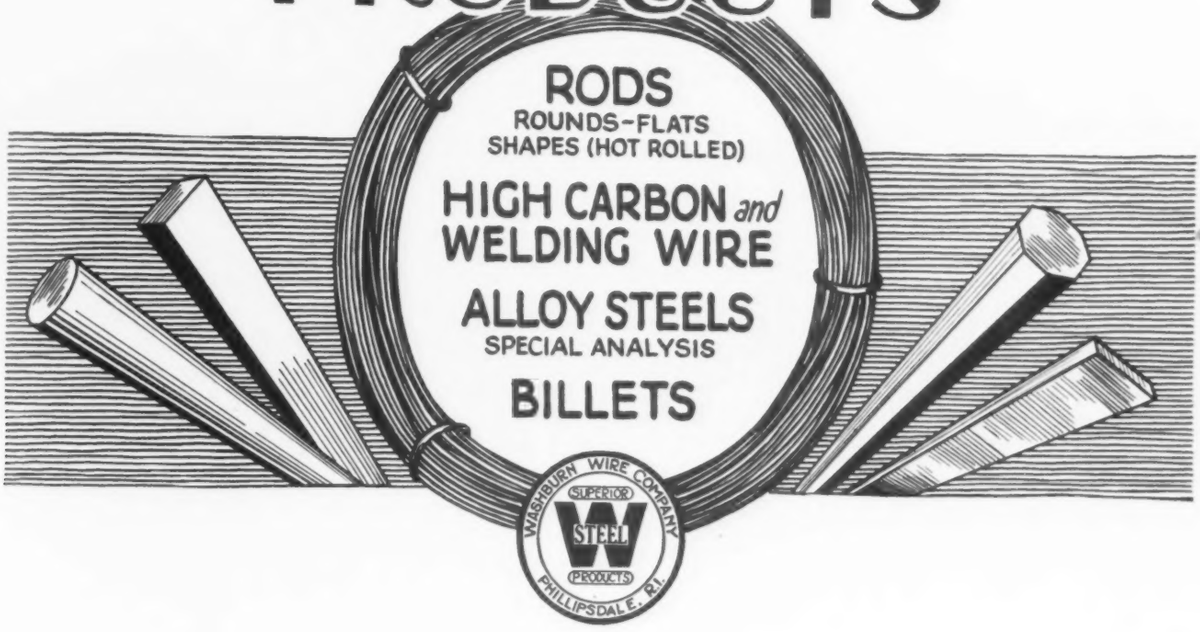
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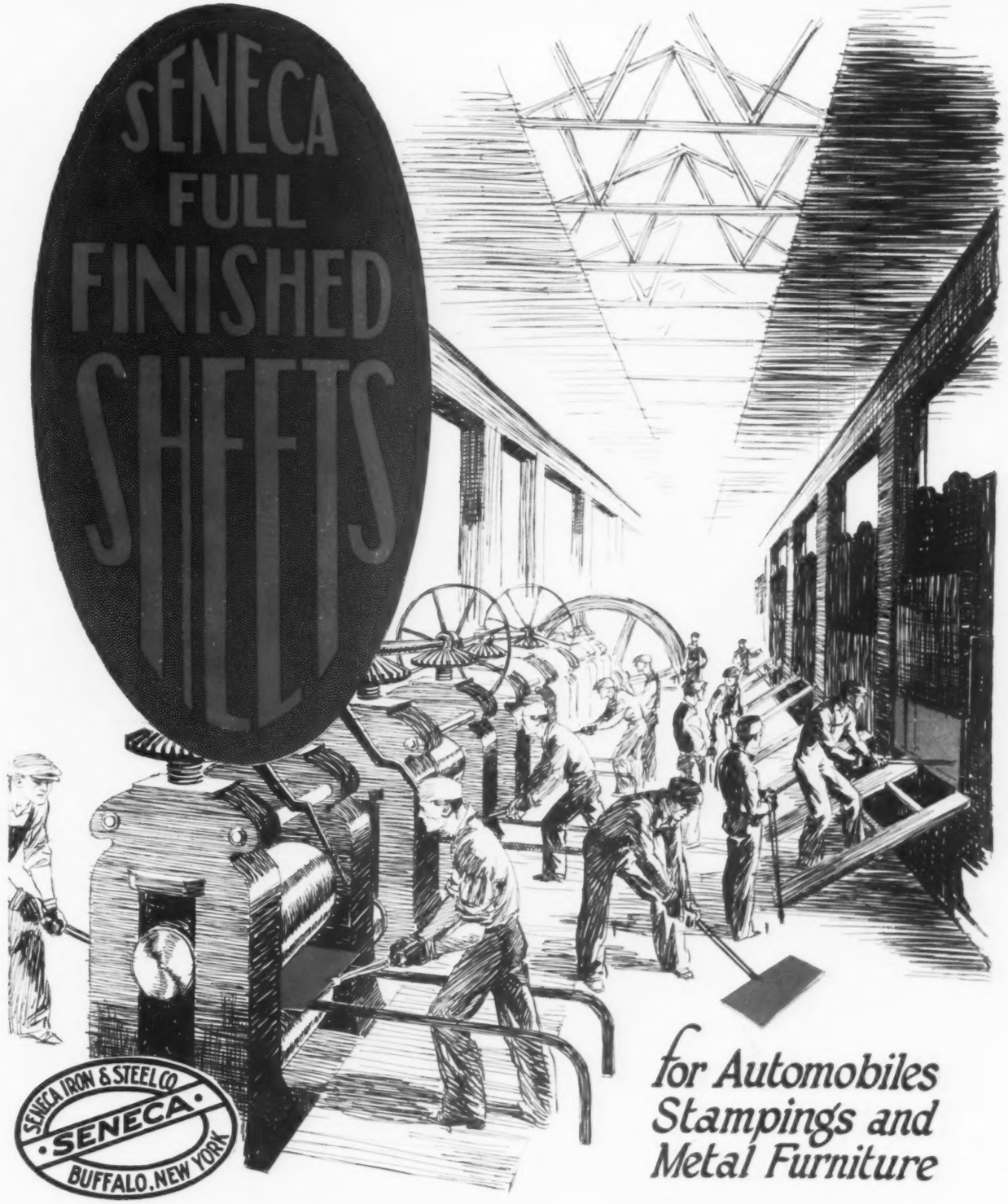
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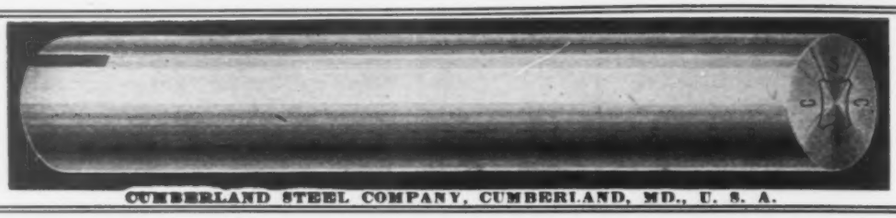
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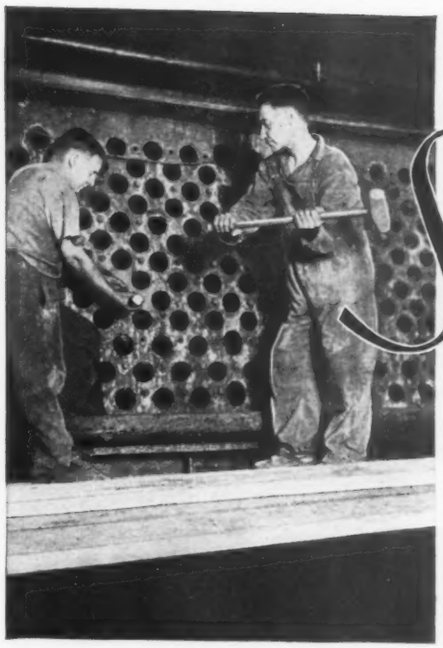
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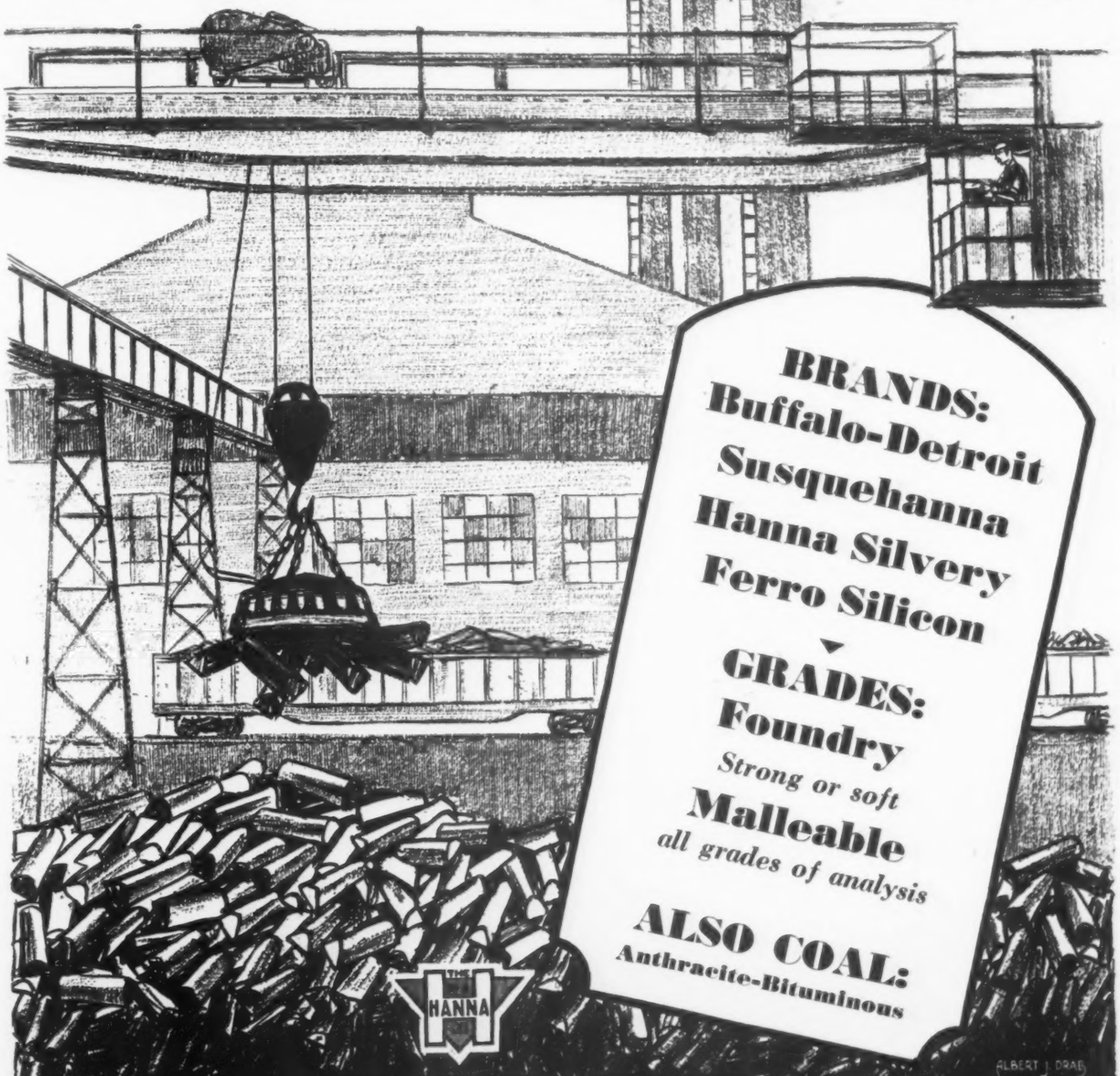
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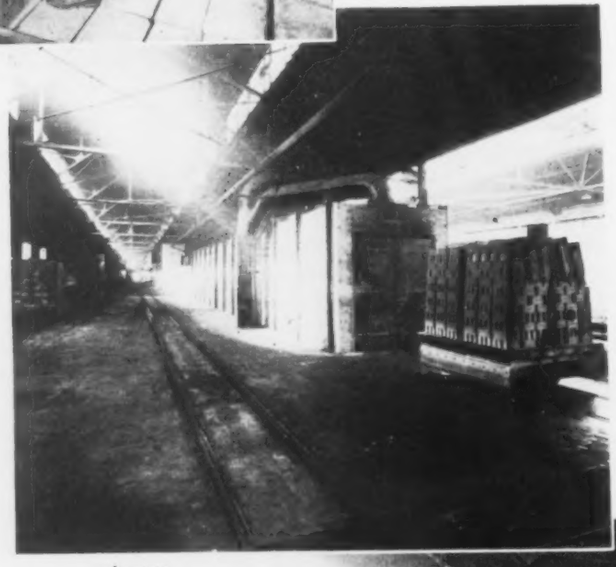
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FIRE CLAY BRICK

Made of the best Pennsylvania clays, carefully selected — dry press manufacturing methods— All Tunnel Kiln Burned.

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Assures uniform burn.

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are today being successfully used in soaking pits.



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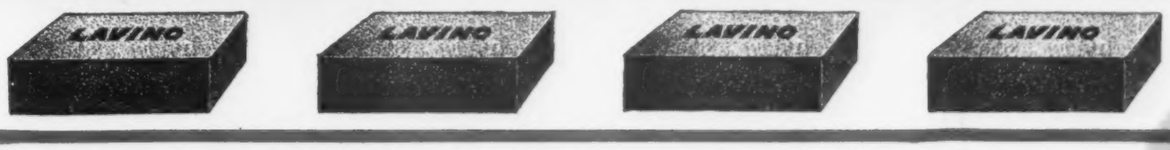
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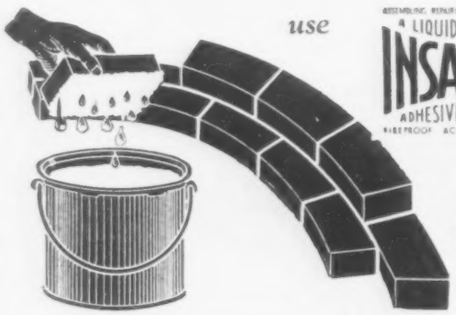
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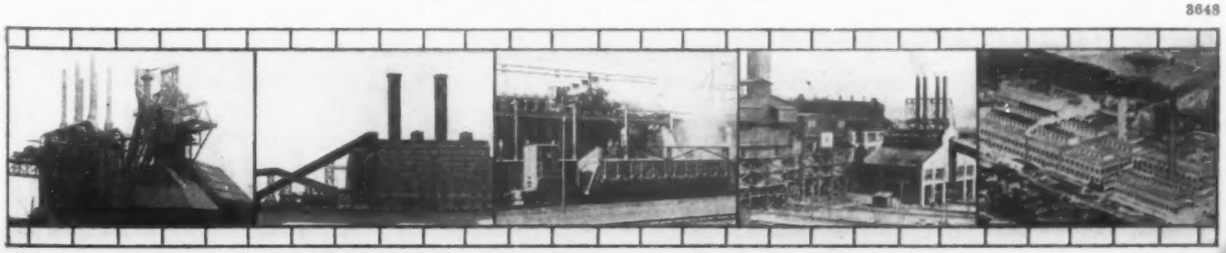
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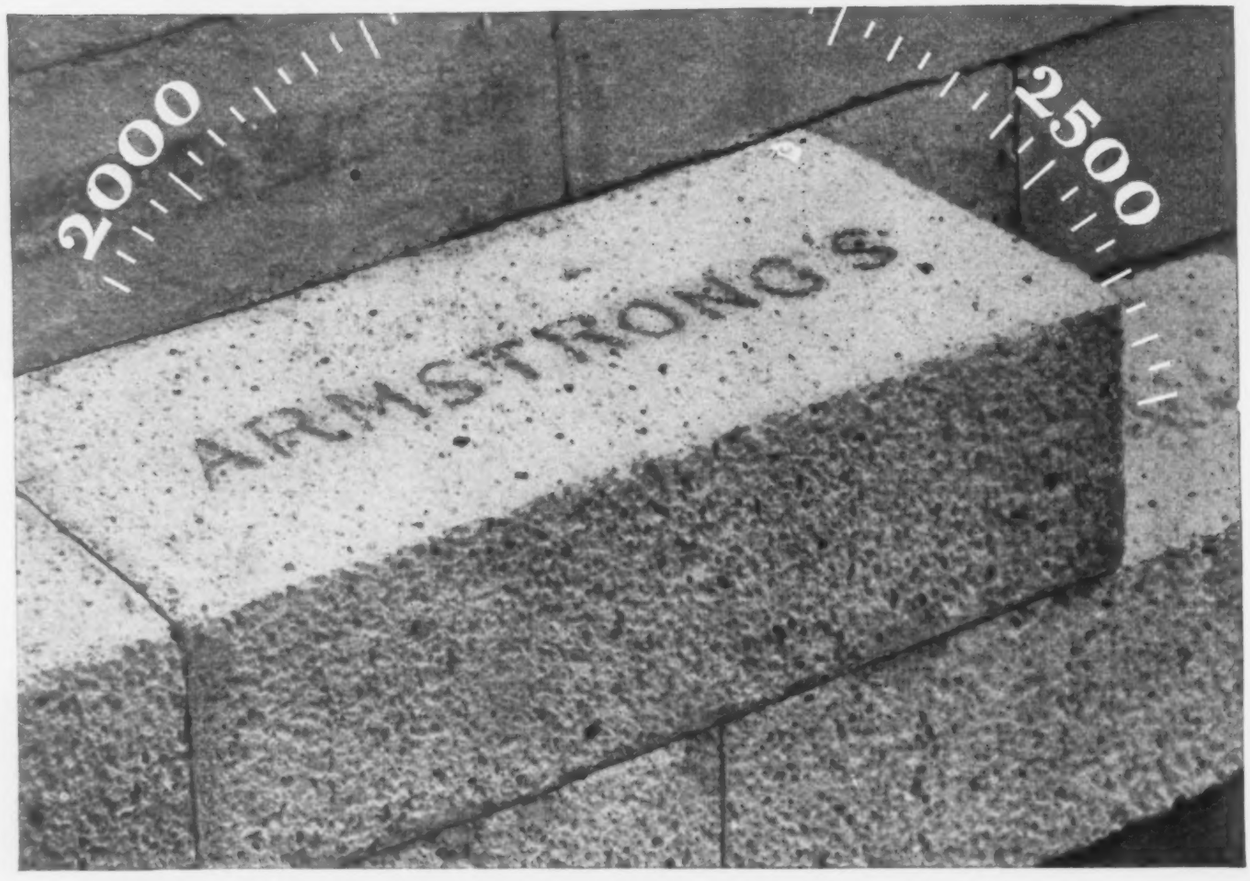
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INSULATION that will stand up at 2000° F. back of the refractory is safe for the normal temperatures of most furnaces. But every now and then something happens to run the temperature higher than normal. This is where the factor of safety comes in—to take care of the overload.

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This heat resistance of Armstrong's Brick has made efficient insulation practicable for equipment that you have always thought "too hot to insulate," such as soaking pits, heating furnaces, regenerator and fantail arches, etc.

A full-size Armstrong's Brick with literature descriptive of the product and its uses will be sent you promptly on request. Address Armstrong Cork & Insulation Company, 923 Concord Street, Lancaster, Pennsylvania.

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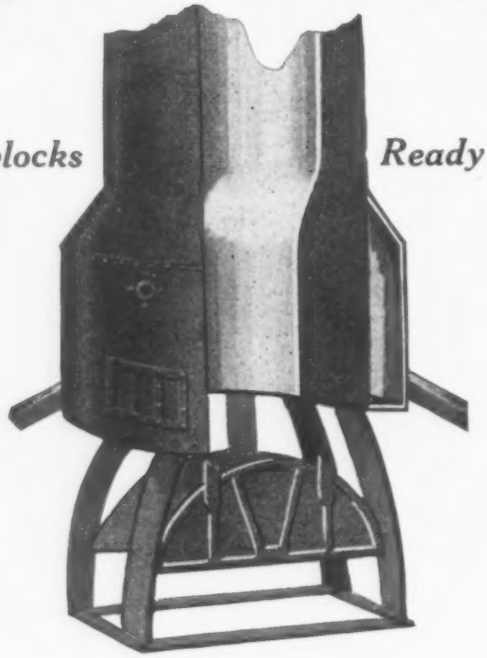
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We sell direct from quarry to consumer only. We have no sales representatives and maintain no branch offices.

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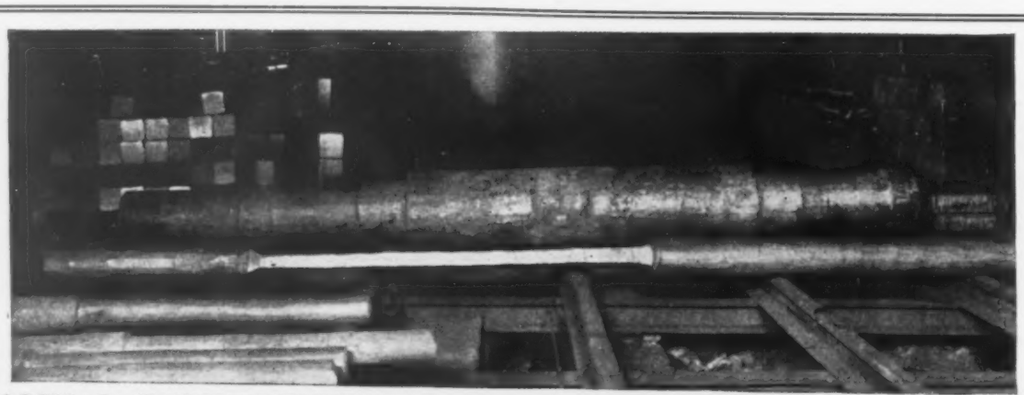
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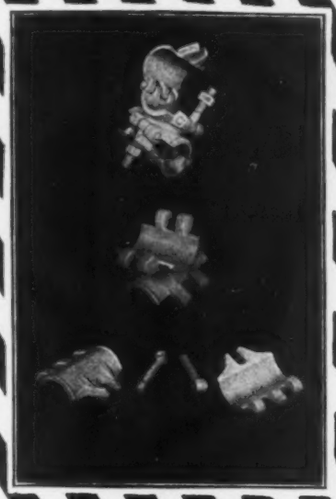
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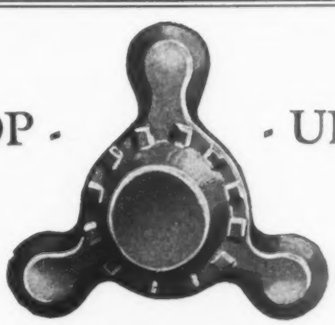
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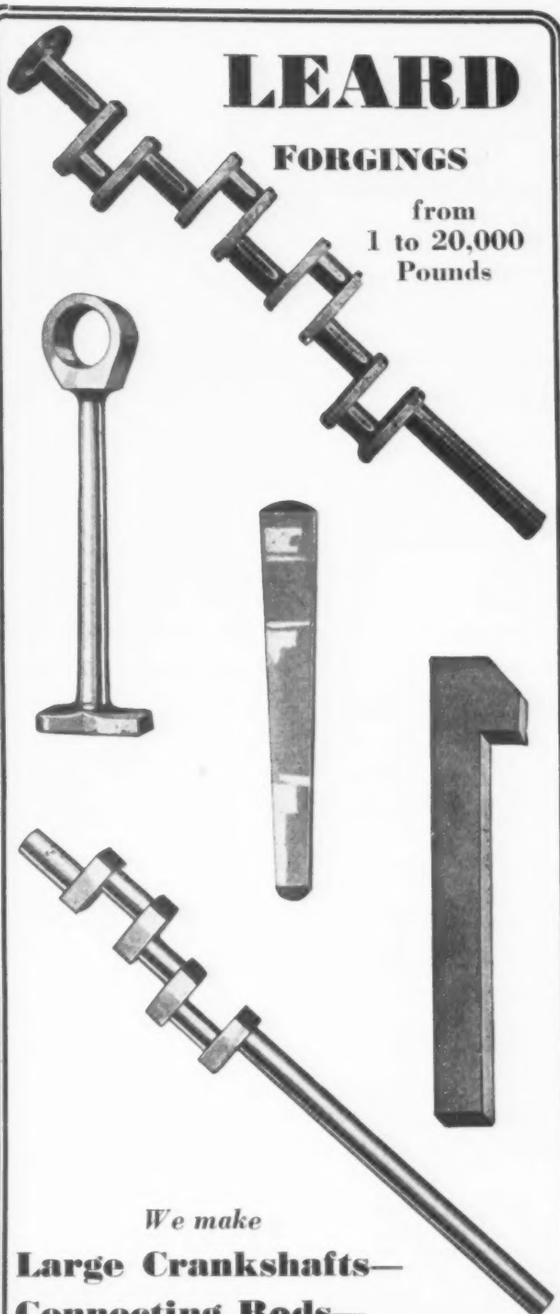
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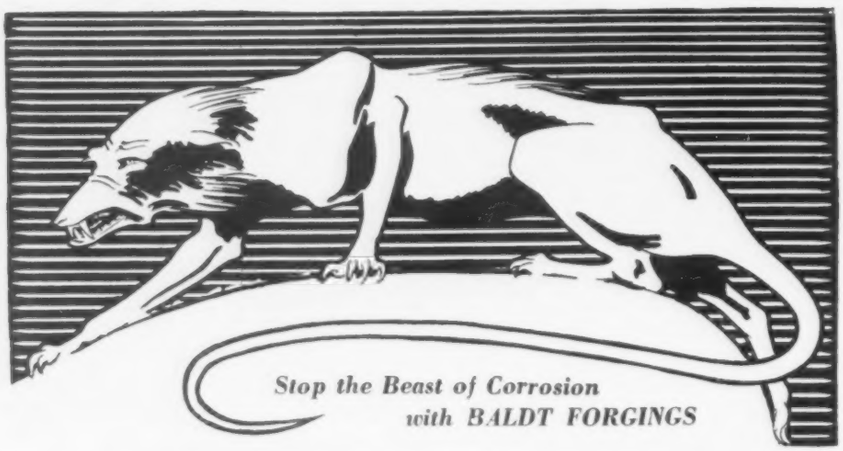
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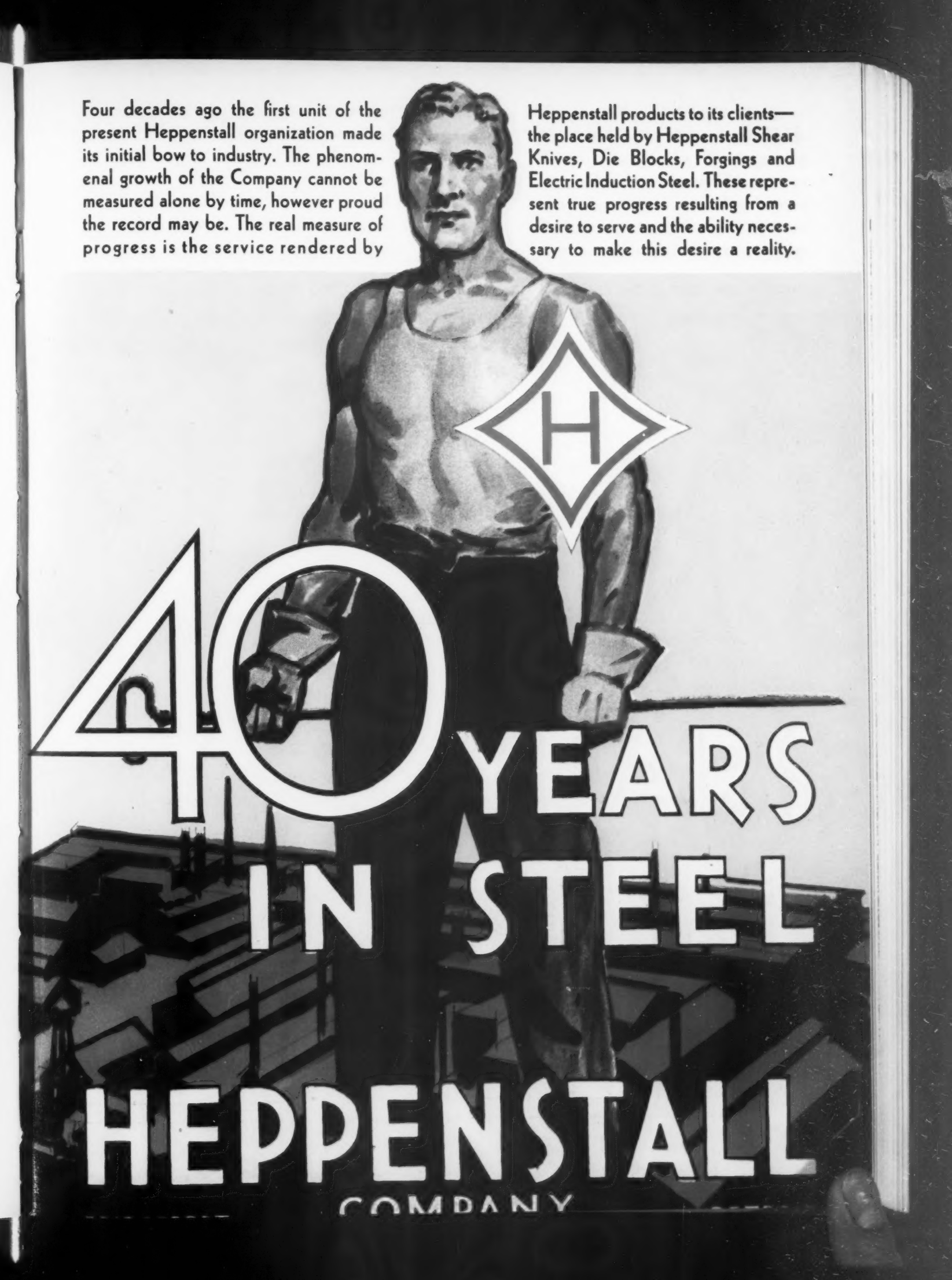
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FORGINGS always are "made to order." Because of this we exercise every care and precaution to make them exactly to your specifications. Close limits are maintained always, effecting substantial savings both in metal and machining costs, regardless of whether you or we machine them. Thus we produce uniformly dependable forgings at a satisfactory price to you.

Milwaukee Forge & Machine Co.

340 Oklahoma Ave.

Milwaukee Wisconsin


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HEPPENSTALL
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Through the use of the Electric Induction Process for steel melting, the finer steels manufactured by Heppenstall have reached a stage which is as near perfection as is possible in the present era. **E.I.S.** Steels, such as are used in the manufacture of the well known Heppenstall Shear Knives and other products are cleaner microscopically and more uniform chemically. They can be absolutely relied upon to keep faith wherever much depends upon the properties of a specified steel.



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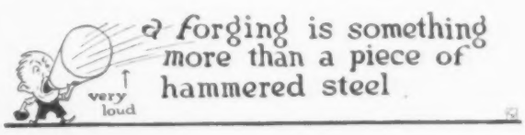


— More Than a Piece of Hammered Steel

Before Champion starts the actual forging process, it makes sure of design, steel and forging method.

Engineers who know every phase of drop forging production and use, analyze the product in which the forging is to be assembled—determining just how those forgings can best be used; what their design must be to give maximum efficiency.

Metallurgists, working in the complete Champion laboratory, aid in selecting a steel that squarely meets the specific demand. Then they direct the forging process to insure proper flow of metal—to make certain of rugged strength in every detail.



Finally they check every step from raw materials to finished forging by microscopic, chemical and physical tests.

That is why Champion drop forgings are more than mere pieces of hammered steel!

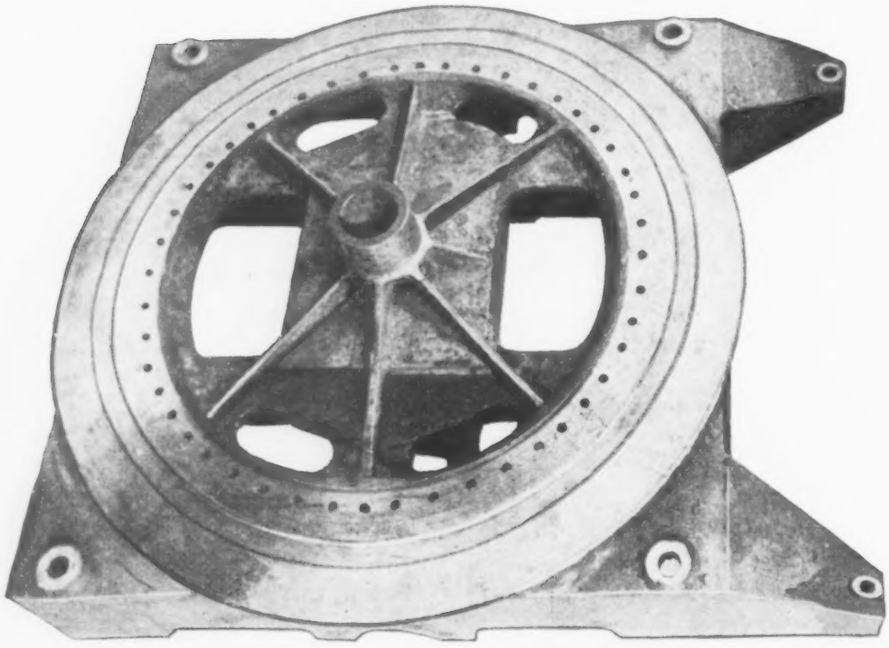
With its extensive plant facilities; its highly trained personnel; its engineers to work with you on the application of drop forgings to your product; and with the laboratory control methods to insure your receiving forgings uniform in quality, free from defects or flaws, and with correct physical properties, Champion is ready to serve you unusually well.

The Champion Machine & Forging Co.

3695 East 78th Street
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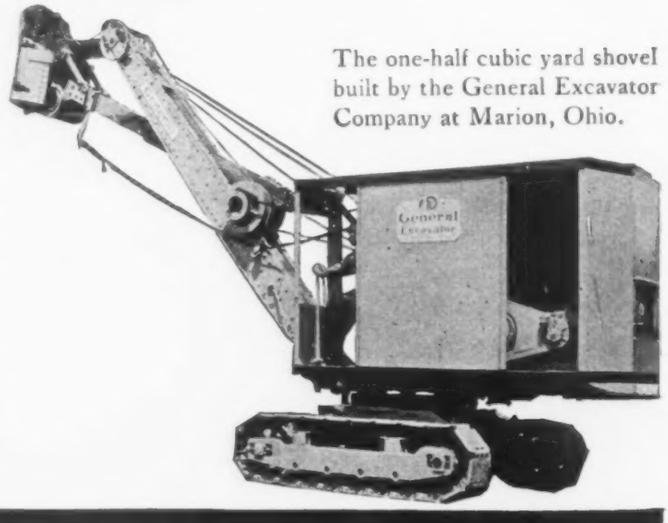
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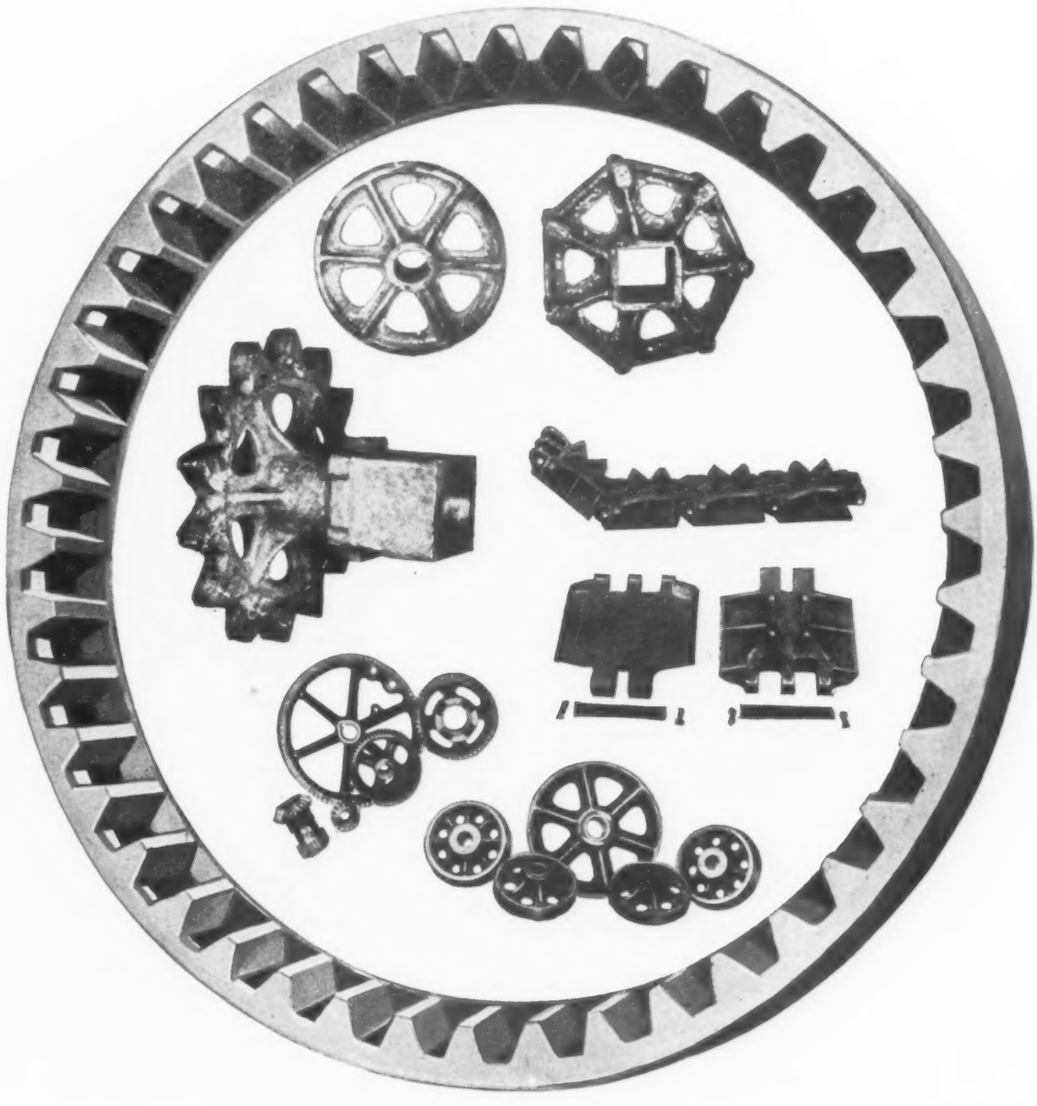
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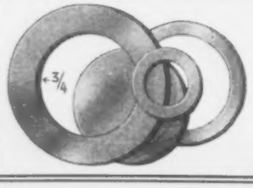
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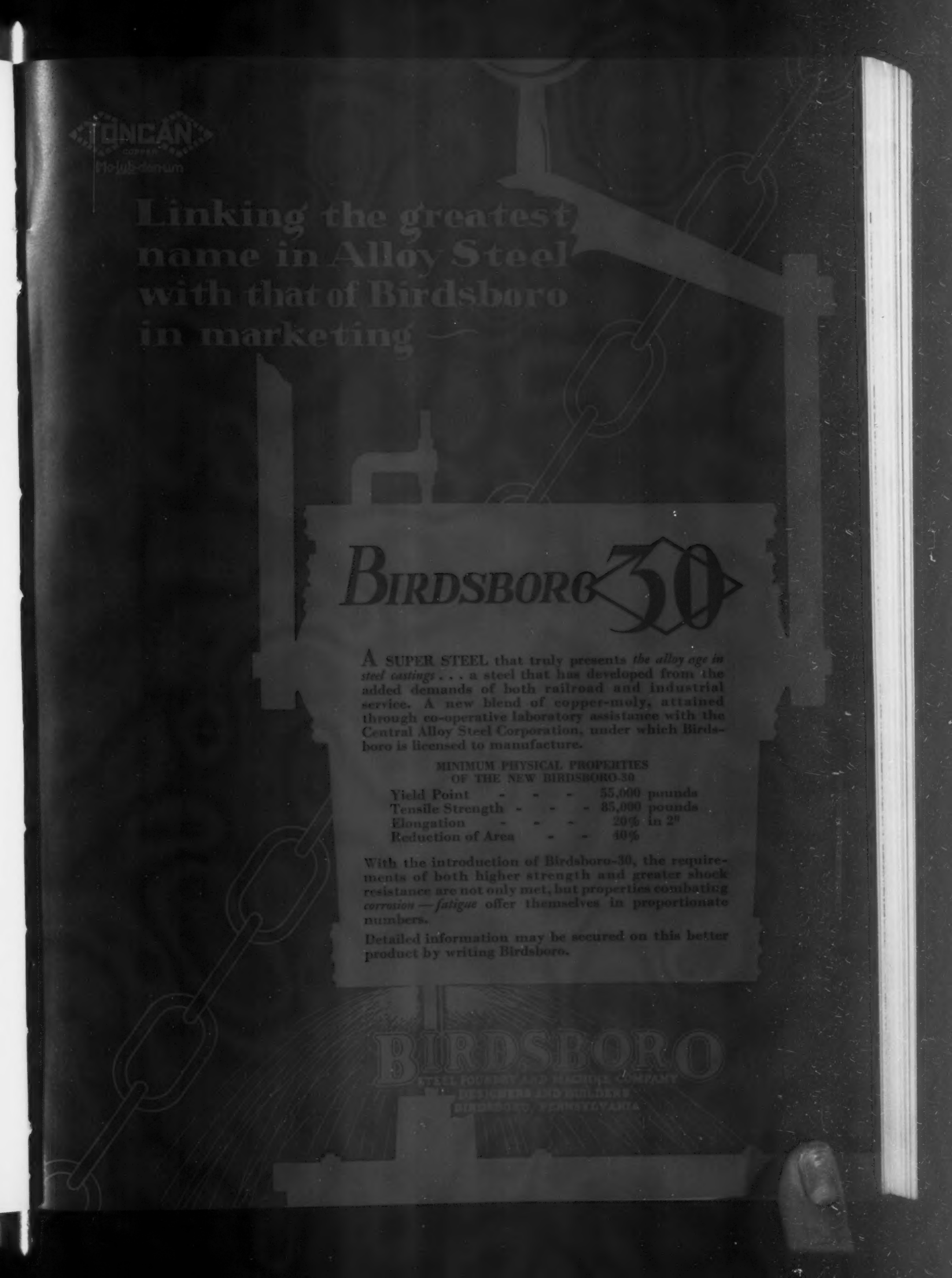
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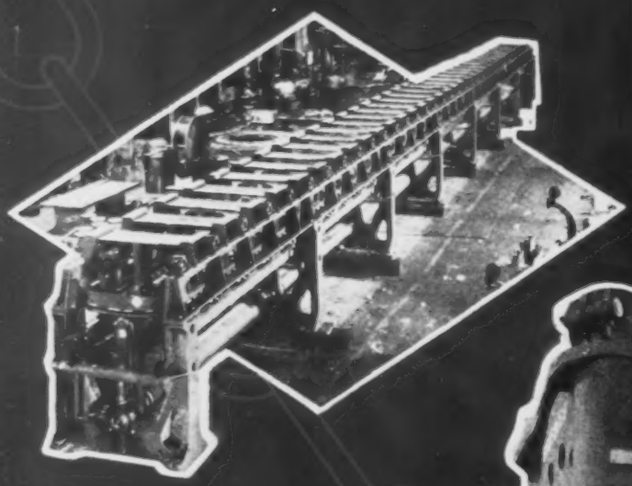


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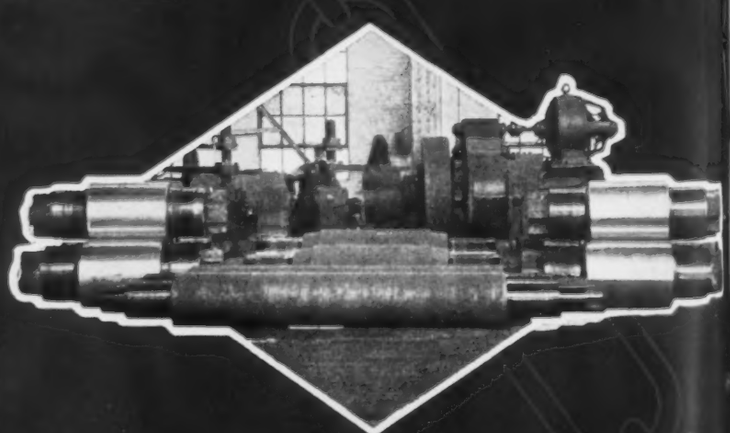


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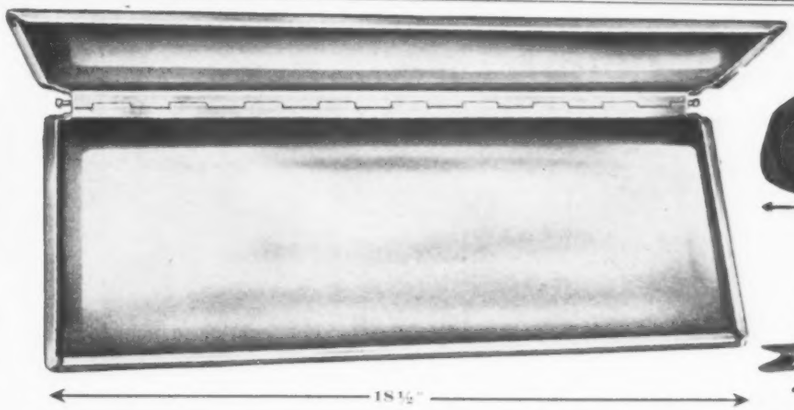
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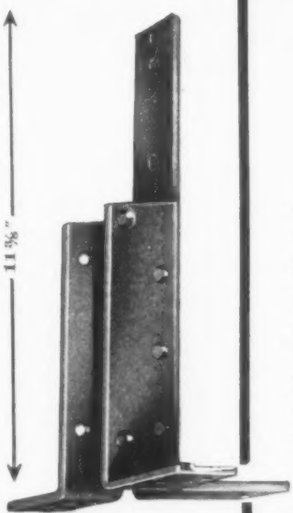












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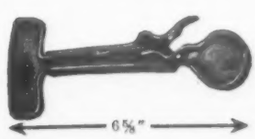
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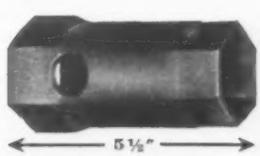
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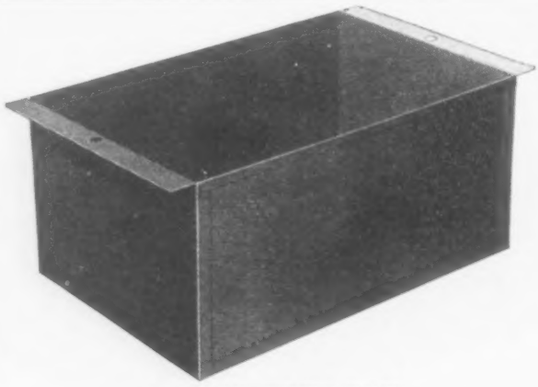
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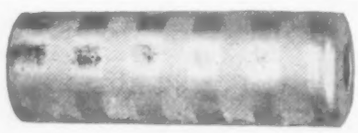
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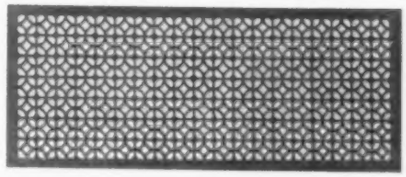
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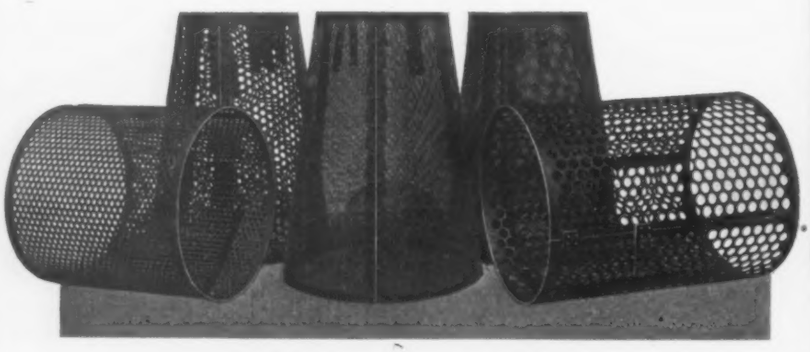
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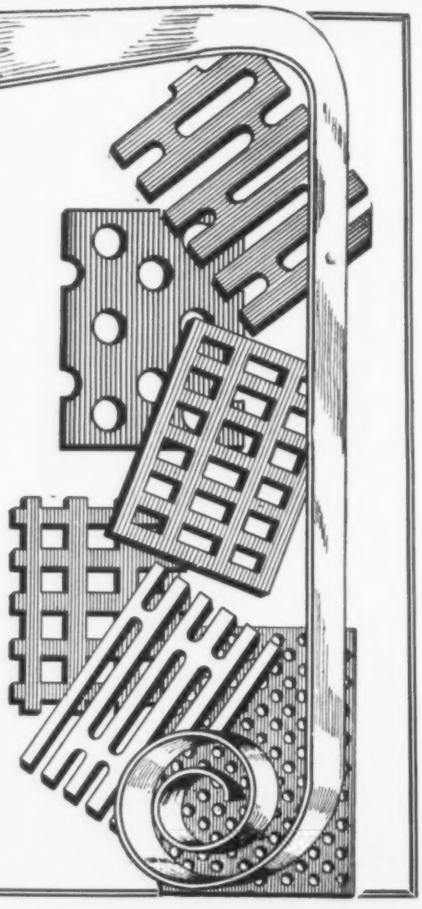
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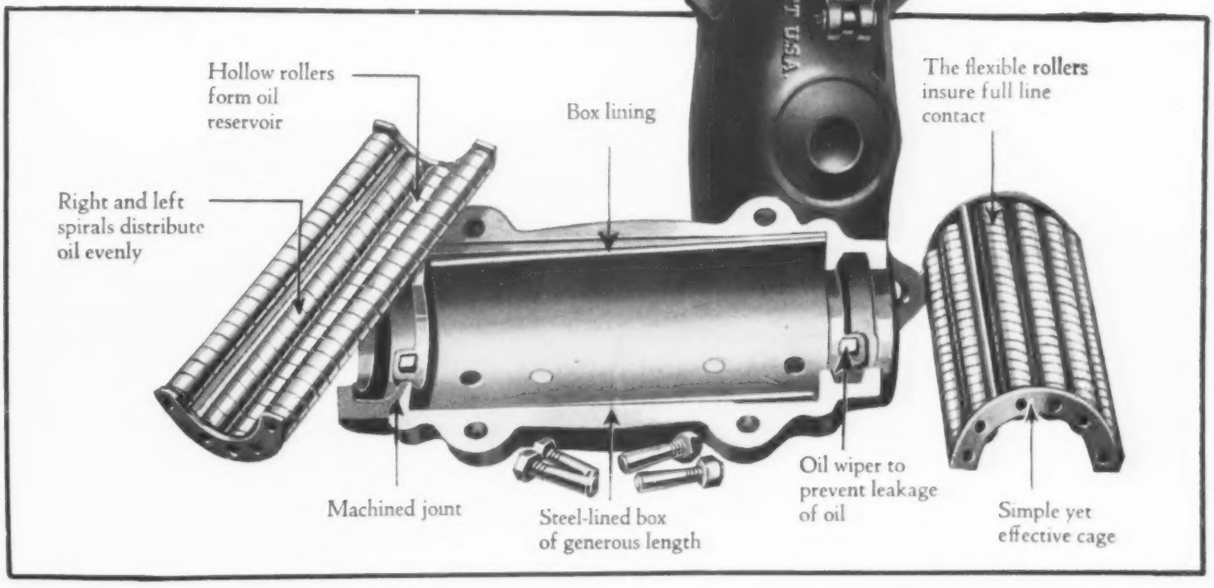
Standard and Special Ball Bearings, Plates, Washers and Rings

63 CLARISSA STREET ROCHESTER, N. Y., U. S. A.

Preferred Features of Design, Installation and Operation

That the design and the construction of this bearing are correct is proved by the fact that Hyatt Line Shaft Bearings installed many years ago are still giving satisfactory service under the most severe conditions.

There is nothing in the bearing to get out of order...nothing to cause trouble, breakdown, or delays. Strong steel Hyatt rollers turn with no appreciable friction or wear...and bring a 15 percent saving to your total power bill. Maintenance cost is nil. The only attention Hyatts require is lubrication three or four times a year.



The change to Hyatt economy is easily and speedily accomplished. For all Hyatt Line Shaft Bearings . . . outside box and roller assemblies . . . are split like other shaft fittings. Nothing is disturbed when they are installed.

HYATT ROLLER BEARING COMPANY

Newark Chicago Detroit Pittsburgh Oakland



Why not have your nearest Hyatt distributor estimate on a modernized, Hyattized, installation.

HYATT

LINE SHAFT ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

All industry, during the last 39 years, has depended largely upon Hyatt performance and economy



Building quality into its own products for more than 38 years, has privileged Hyatt to symbolize the protection which Hyatt Roller Bearings afford other quality products.

Where the best is needed only the best is used

A striking example of the exacting performance which machinery manufacturers are building into their products is evidenced by the widespread employment of Hyatt Roller Bearings at all strategic positions.

Where nothing but Hyatt Roller Bearings would accomplish the desired results — Hyatt Roller Bearings are installed.

This reliance upon Hyatt Bearings to preserve and protect the excellence of the products of which they become a part is a tribute to Hyatt design and dependable performance.

More quiet operation, freedom from adjustments, perfect alignment of shafts and gears, longer life to the entire equipment, and efficient transmission of power are the essential bearing qualities which engineers look for and obtain in Hyatt Roller Bearings.

HYATT ROLLER BEARING COMPANY

Newark Detroit Chicago Pittsburgh Oakland

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

In material handling equipment, as in so many other important applications Hyatts guard permanently

19 YEARS



Not theory alone but more than nineteen years practical experience forms the background for the bearing recommendations of Rollway Engineers for heavy industrial applications. Rollway Cylindrical Roller Bearings built the foundation on which the present general use of roller bearings in heavy duty service is based. Their performance over a period of years, often in applications considered too difficult for roller bearings has instilled into the minds of designing Engineers and Operating men the confidence they have in them, a confidence held not by what we say or hope Rollway Cylindrical Roller Bearings will do, *but what they have done.*

ROLLWAY BEARING
COMPANY **INCORPORATED**
SYRACUSE NEW YORK

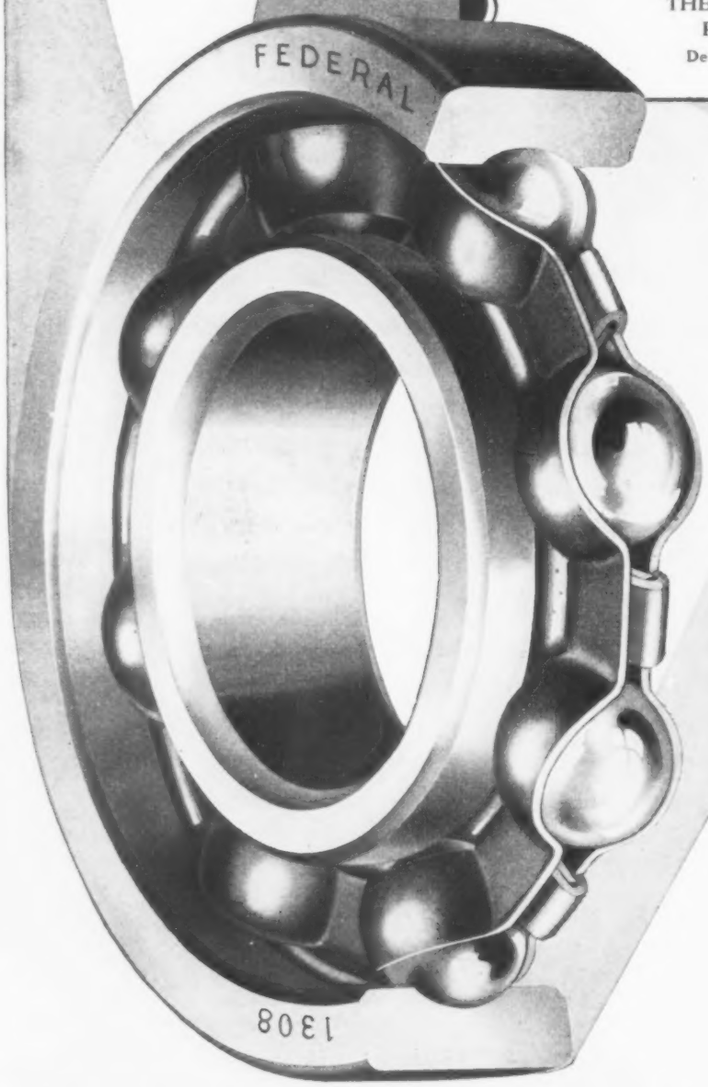
ROLLWAY
CYLINDRICAL ROLLER
BEARINGS

FEDERAL

THE NATION-WIDE REPUTATION of Federal Radial Ball Bearings is based upon performance. "Federals" not only meet every bearing requirement, but they do so in an economical and efficient manner. They last longer, easily sustain great speeds and heavy loads and their quality cannot be surpassed. Hundreds of manufacturers in various industries unite in the opinion that "Federal" represents the highest achievement in the art of building bearings.

We shall be pleased to forward samples, quotations and complete information to those interested

THE FEDERAL BEARINGS CO., INC.,
POUGHKEEPSIE, NEW YORK
Detroit Sales Office: 917 Book Building





RADIAL BALL BEARINGS

Serving INDUSTRY

American Roller Bearings are used as standard equipment by hundreds of manufacturers of heavy machinery and equipment. These manufacturers build for practically every industry.

The year of 1930 marks the beginning of our eighteenth year of specialization in the design and manufacture of roller bearings for industrial purposes exclusively.

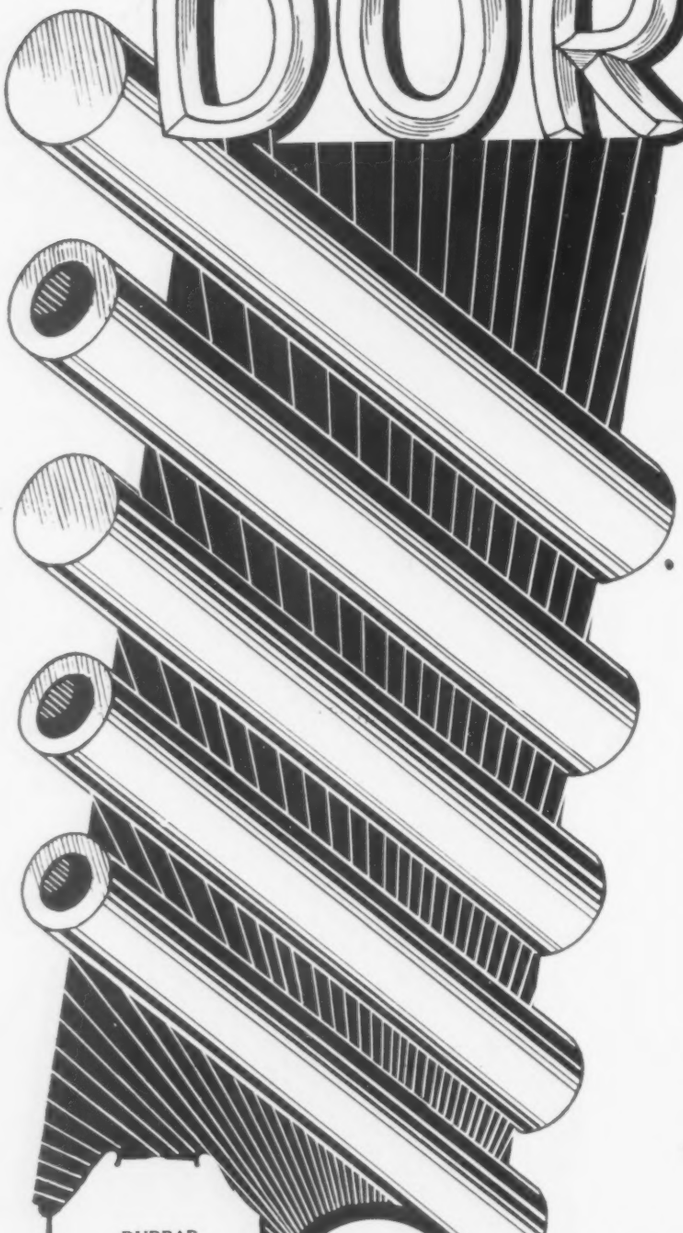
Our catalog contains data and technical information of value to every manufacturer and user of heavy machinery and equipment.





AMERICAN ROLLER BEARING COMPANY, PITTSBURGH, PA

DURBAR



High Lead Bronze
BEARING METAL

In every shop in every branch of industry, tne first and foremost problem is to maintain steady and uninterrupted production. High speed, so very essential in this modern industrial age, requires bearings that will give maximum efficiency and service at a low cost.

DURBAR High Lead Bronze Bearing Metal was developed to meet these modern bearing problems. It is highly recommended as a superior substitute for phosphor bronze and babbitt lined bearings. On some installations it has outlived other bearing metals from 6 to 10 times.

DURBAR Bearing Metal is available in Standard, Soft, Hard and Extra Hard grades; in stock bars and special castings. No special tools are required for machining.

Consult our staff of metallurgists with your problems.

DURBAR BEARING BRONZE

A *high lead* bronze bearing metal giving the longest service at the lowest cost.

SPECIALISTS in SAND CAST ALUMINUM BRONZE CHILL CAST TIN BRONZE and ALUMINUM BRONZE DIE CASTINGS

Durbar Bearing Bronze in stock bars 12" long in STANDARD and HARD GRADES. Outside diameters from 1¼" by ¼" to 3½"; by ¼rs to 4½". Inside diameters from ⅝" by ⅛ths to 3¾". Sizes 4¾" to 8" O.D., 4" to 6" I.D., and special castings furnished promptly on special order.

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BUFFALO BRONZE
DIE CAST CORPORATION
100 Arthur St. Buffalo, N.Y.

New!

"SABECO-ed STEEL BEARINGS"

Now you can secure a bearing having all the advantages of "SABECO" for the price of the ordinary bronze bearing.

It is the latest creation in modern cost reducing in the bearing field.

Sabeco-ed Steel Bearing consists of an outer shell of steel tubing to the inside of which the proper thickness of "SABECO" Bearing Metal is inseparably fused.

In "SABECO-ed" Steel Bearings you get all the wonderfully efficient performance and extremely long life of "SABECO" Metal plus Greater Strength, Lower Coefficient of Expansion, and Greater Resistance to Deformation.

"SABECO-ed" Steel Bearings can be used for practically all purposes for which bronze bearings are employed. They are so far superior to anything in the bronze bearing field that you should give them your serious consideration.

Would you like a sample and more detailed information? Write.

Fredericksen Company

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Actual photograph of turning from "SABECO-ed" Steel Bearing showing how bronze and steel become physically one piece.

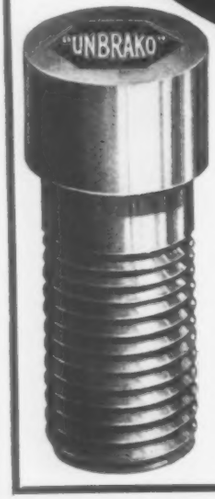


"SABECO-ed STEEL BEARINGS"

PATENT APPLIED FOR

"Know Your Bearings"

UNBRAKO



The trade-name in the oval describes our Screws exactly —you just can't break them and that is that.

Free samples for doubting Thomases—and if they don't convert you to "UNBRAKO" Screws, we'll quit.

Bulletin 398—Yours for the Asking



STANDARD PRESSED STEEL CO.

BRANCHES BOSTON CHICAGO DETROIT

JENKINTOWN, PENNA.

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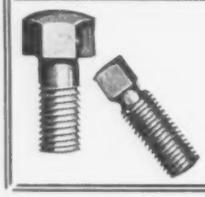
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CLOSE TOLERANCES
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ACCURATELY MADE AT A FAIR PRICE ARE MORE ECONOMICAL

Specialists in the production of screw machine products for 15 years. Let us quote on your requirements.

Screw Machine Products Corp., 1014 Eddy St., Providence, R. I.



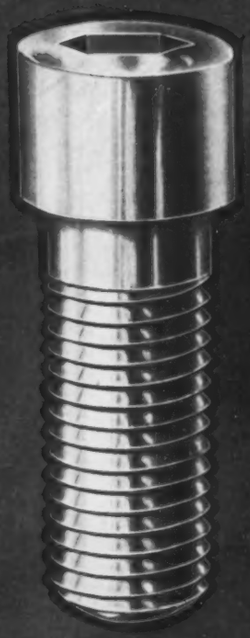
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CAP AND SET SCREWS
The
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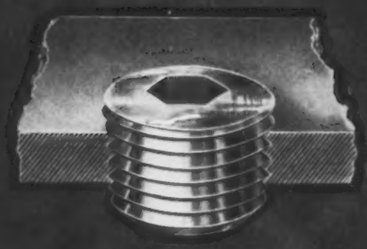
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HOLLOW SET and CAP SCREWS

You accept "ALLENS" like old friends; you use them with absolute confidence; you leave them with every assurance that they'll hold... After 19 years of careful development, you buy no experiment... Neither money, machinery nor ingenuity can give you a better screw—or ALLEN would have it for you. May we put our new Catalogue into your hands?

THE ALLEN MFG. COMPANY, Hartford, Conn.



A new year . . . a new record

THE year past has seen the recognition by many leaders of industry of the unmatched qualities of Cleveland Cap Screws produced by the Kaufman Method, *patented. Claims* of quality merely cannot make good when the order is shipped. Users of Cleveland Cap Screws know definitely just what qualities of superiority they have.

A new year and a new record are before us, as well as before our customers. We intend that whatever we can do to make Cleveland Cap Screws still better, shall be done. And we enter 1930 with a plant that has no superior for modern equipment used in making good cap screws. Shipments are prompt, on large and small quantities.

THE CLEVELAND CAP SCREW CO., 2930 E. 79th St., Cleveland, Ohio

Address the Nearest Company Warehouse—Complete Stocks At

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CLEVELAND

CAP SCREWS



The Final Touch....

If you'd like samples and quotations we'll be glad to supply them, without obligation. Just write us on your own letterhead.

On the strength and fit of the smallest parts rests the ultimate success of many an assembly. That's why industry is turning to Ferry Cap and Set Screws. Strong enough to stand the strain of much overloading and precision-built to perfect fit, thus adding speed to production. Handsomely finished to give a neat, attractive appearance to the finished job... And with Ferry products goes a service that supplies quickly, millions of Cap Screws, Set Screws, Acorn Nuts and Screw Machine Products to meet your most insistent demands....That's all a part of Ferry Quality.... measured in both products and service.

THE FERRY CAP AND SET SCREW COMPANY · *Cleveland, Ohio*

FERRY

PROCESS SCREWS



Only a Screw... but worth a fortune to the makers of Budd *All-Steel* Bodies

This little Screw doesn't appear to be particularly important. You would probably overlook it if you were to inspect one of the famous Budd automobile bodies. Yet in a single year, the E. G. Budd Manufacturing Co. saved $152,500.00* by using Hardened Self-tapping Sheet Metal Screws in place of machine screws and other devices for making fastenings to sheet metal.

Three slow and difficult assembly operations were eliminated . . . tapping, the making of tap plates, and the welding of these plates to the sheet metal. To make assemblies with Self-tapping Screws it is only necessary to turn in the Screw with a screw driver. A fastening made this easy way holds better than a machine screw fastening even under vibration. Budd proved this by severe tests.

In more than 35,000 plants . . . on sheet metal products of every description . . . Hardened Self-tapping Sheet Metal Screws are materially reducing assembly costs.

Do not fail to test these Screws on your own work. If you can use them, they will save you time, labor and money. We will furnish proper samples, free . . . just send a brief description of your assembly.

* This saving is explained in detail in a survey made by independent engineers and certified by Budd officials. Write for a copy.

PARKER-KALON CORPORATION, 196 Varick Street, NEW YORK, N. Y.
Distributed in Canada by Aikenhead Hardware Ltd., 19-21 Temperance St., Toronto



Easier - Quicker - Cheaper
sheet metal assemblies

Merely turn a Self-tapping Screw into a drilled or punched hole. The Screw taps its own thread in the metal and binds the sections firmly together.

PARKER-KALON
HARDENED SELF-TAPPING
Sheet Metal Screws

PATENTED APR. 1, 1919 — No. 1299232 — MAR. 28, 1922 — No. 1411184
AUG. 14, 1923 — No. 1465148 — FEB. 10, 1925 — No. 1526182 — OTHERS PENDING

Mac-*its* in forming dies

RIGIDITY and permanent accuracy of alignment of the forming dies built by the Kinzig Tool Company depends entirely upon the strength of MAC-IT Hollow Head cap screws and the dowel pins used. The steel die sections are not set into the base.

This particular forming die for use on a Verson press is designed for producing tractor cab window frames, and is typical of the fine product manufactured by this well-known die-maker.

The extraordinary strength of MAC-IT screws has made them generally accepted as standard parts by builders of fine machine tools and production machinery. Design engineers know that a MAC-IT will not break, mushroom at the point or become distorted with long use under most severe service.

Send blueprints for quotations on special types.

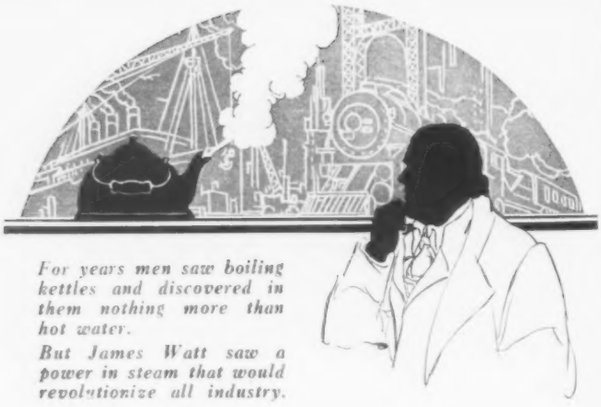


STRONG CARLISLE & HAMMOND

Mac-it Cap Screws are made in Socket, Fillister, Button, Flat, Round, Hexagon and SAE Hexagon Head in a full list of sizes. Price List and samples on request.

Mac-it Set Screws are made in Hollow, Square-Head, Tool Post, Mining Machine, Railroad Eccentric and Slotted Headless types in a full list of sizes. Ask for Catalog.

1392 WEST THIRD STREET, CLEVELAND, OHIO



For years men saw boiling kettles and discovered in them nothing more than hot water.

But James Watt saw a power in steam that would revolutionize all industry.

For years the advantages of applying the dovetail principle to screw sockets were not realized.

Then . . . just as the power of steam revolutionized industry, so the unique dovetailed socket design of Bristo Socket Head Cap Screws set new standards of performance.

Bristo Socket Head Cap Screws are made of nickel steel, forged and heat treated for greatest strength.

This toughness, plus the extra tight grip which the patented Bristo Socket gives, permits their use in out-of-the-way positions where ordinary cap screws would be wholly impractical.

For many manufacturers, Bristo Socket Head Cap Screws have helped to improve their products. They *might* do this for you. At any rate, it should merit closer study, and for that we will be glad to send sample screws in any sizes.

BRISTO
SOCKET HEAD CAP SCREWS
THE BRISTOL CO. WATERBURY, CONN.
Dept.—D



One Standard of Quality in every Type and Size

Reed and Prince Products *include:*

Wood Screws
Machine Screws
Cap Screws
Set Screws
Stove Bolts
Sink Bolts
Hanger Bolts
Machine Screw Nuts
Stove Bolt Nuts
Chair Rods
Stove Rods
Seat Rods
Specialties

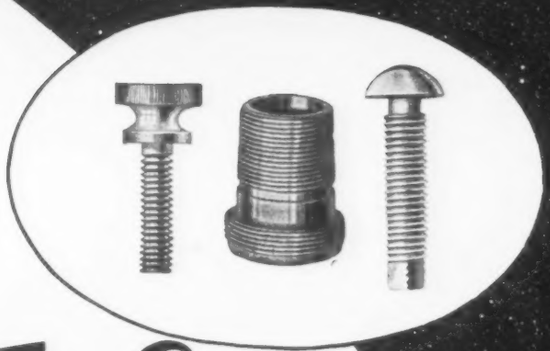
Available in any finish — nickel, blued, copper, bronze, brass, galvanized, plain, polished, cadmium, chromium.

Reed & Prince Screw Products can be depended upon for unvarying uniformity in strength, finish and dimensions. Every Screw, Nut and Bolt meets the highest standards of quality and accuracy.

For GOOD WORK use dependable Reed & Prince Products. Your largest requirements can be handled promptly. May we submit samples and prices.

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Standard CAP and SET Screws
MILLED STUDS
SEMI-FINISHED NUTS
CASTLE NUTS SLOTTED NUTS
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S.A.E. Nuts
Jack Chain
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Safety Chain
Furnace Chain
Ladder Chain
Sash Chain
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Speedometers

CORBIN

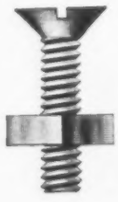


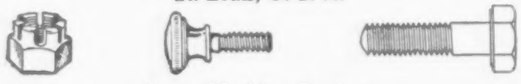
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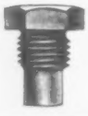
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The American Hardware Corp., Successor
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Warehouses—New York, Chicago, Philadelphia
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St. Louis, U. S. A.

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It is perfectly obvious that small gears, pinions and special shapes can be sliced from the bar more cheaply than they can be individually cut from the solid. That is providing other things are equal—the shapes uniformly accurate, the metal right, the initial cost low. Here at the Rathbone plant we take every precaution to guarantee them so.

Many manufacturers are now eliminating a number of special operations—saving time, simplifying their assembly, holding their assembly to greater uniformity, because they took up with Rathbone engineers the comparative costs of both ways. That is the basis of our success with other firms, and on this basis have we built a large business.

Rathbone shapes are made in bronze, brass, steel, nickel silver and other metals and are available in a number of standard shapes as well as in the special shapes developed to your specifications.

If the cost of your small parts bulks large in proportion to your total costs, we can show the way to economies that will be worth your while. Let us demonstrate.

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PALMER, MASS.



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We control all manufacturing processes from the billet to the last finishing process.

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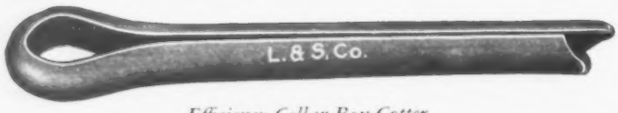
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Efficiency Cellar Box Cotter
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Square Head and Nut Lamson Machine Bolt



Oval Head Lamson Ribbed Carriage Bolt



"Buckeye" Tire Bolt



Round Head Stove Bolt



Flat Head Stove Bolt



Gimlet Point Lag and Skein Screw with Square Head



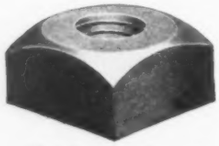
Oval Head Lamson Carriage Bolt



Cold-Punched Chamfered and Trimmed Nut with Reamed Hole



Semi-Finished Castellated Nut



Hot Pressed Square and Hexagon Nut



No. 3
Round Head Square Shank Plow and Cultivator Bolt with Forged Square Nut Finished Point



Bull Dog Wire Rope Clip



No. 1
Flat Head Elevator Bolt



It pays to standardize on Lamson Bolts, Nuts and Cotters. The L & S combination of strength, accuracy, proper packaging and prompt delivery assures you unfailing Top-quality from a single source of supply for every item you need.

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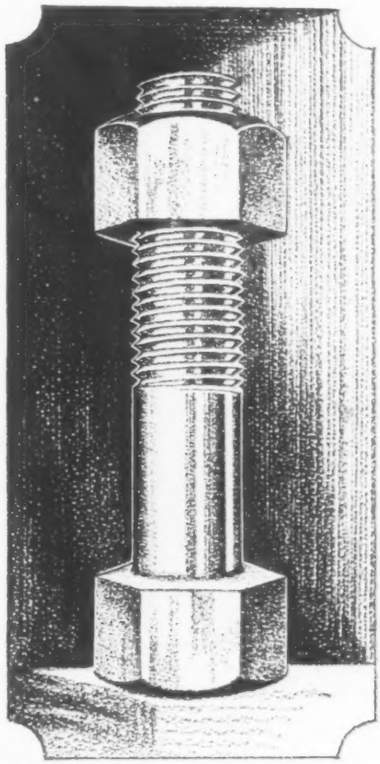
Efficiency Cotter Assortments
Screw Top Tin Box

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MALLEABLE IRON

Formerly made by Thomas Devlin Mfg. Co., Philadelphia





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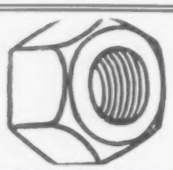
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PLAIN—FEATHER
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TAPER PINS

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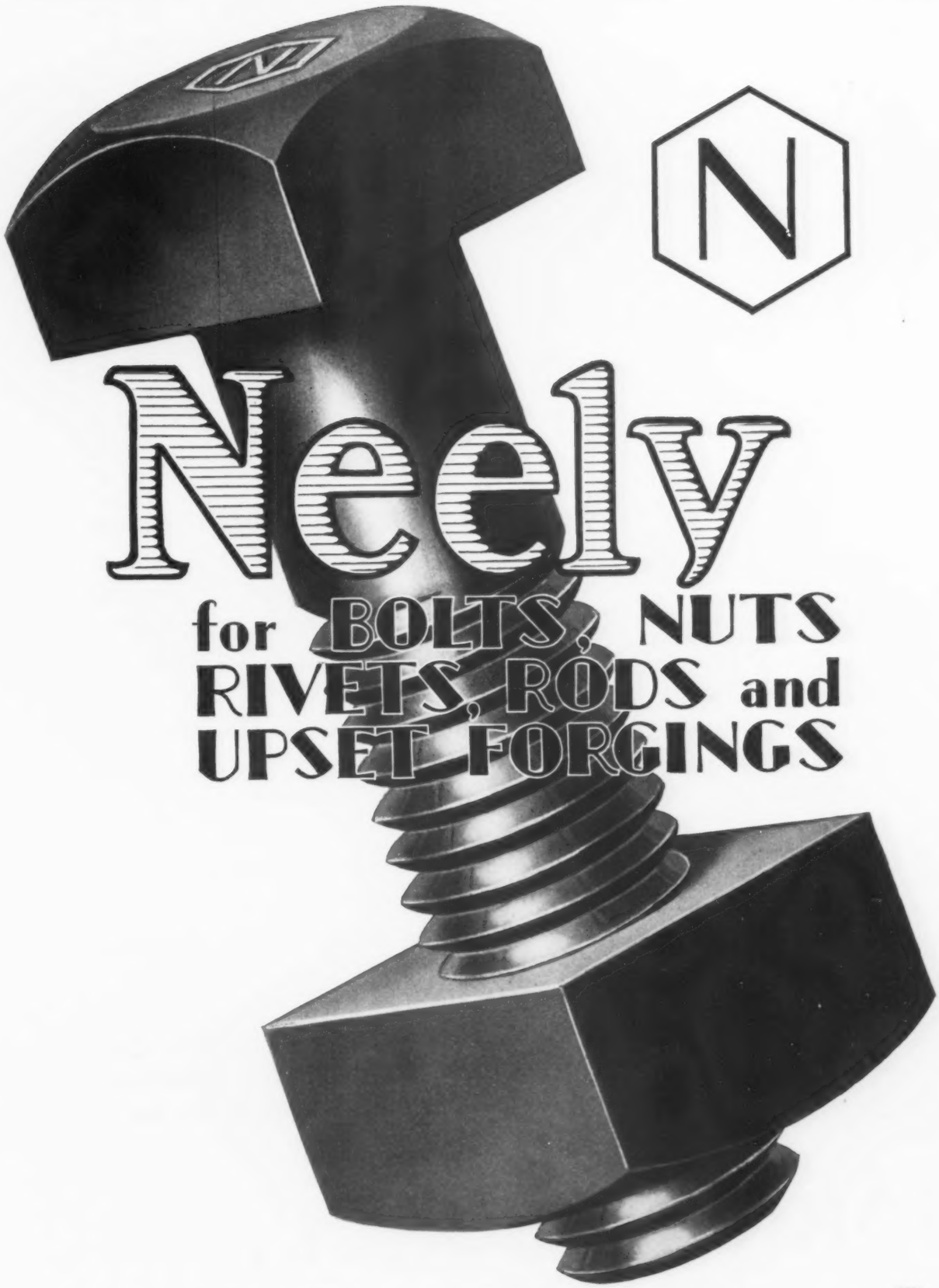
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62 Clyde St., Buffalo, N. Y.



STANDARD and SPECIAL
NUTS
MILLED FROM BAR
WESTFIELD NUT COMPANY WESTFIELD, MASS.







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for BOLTS, NUTS
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Special Wire Nails

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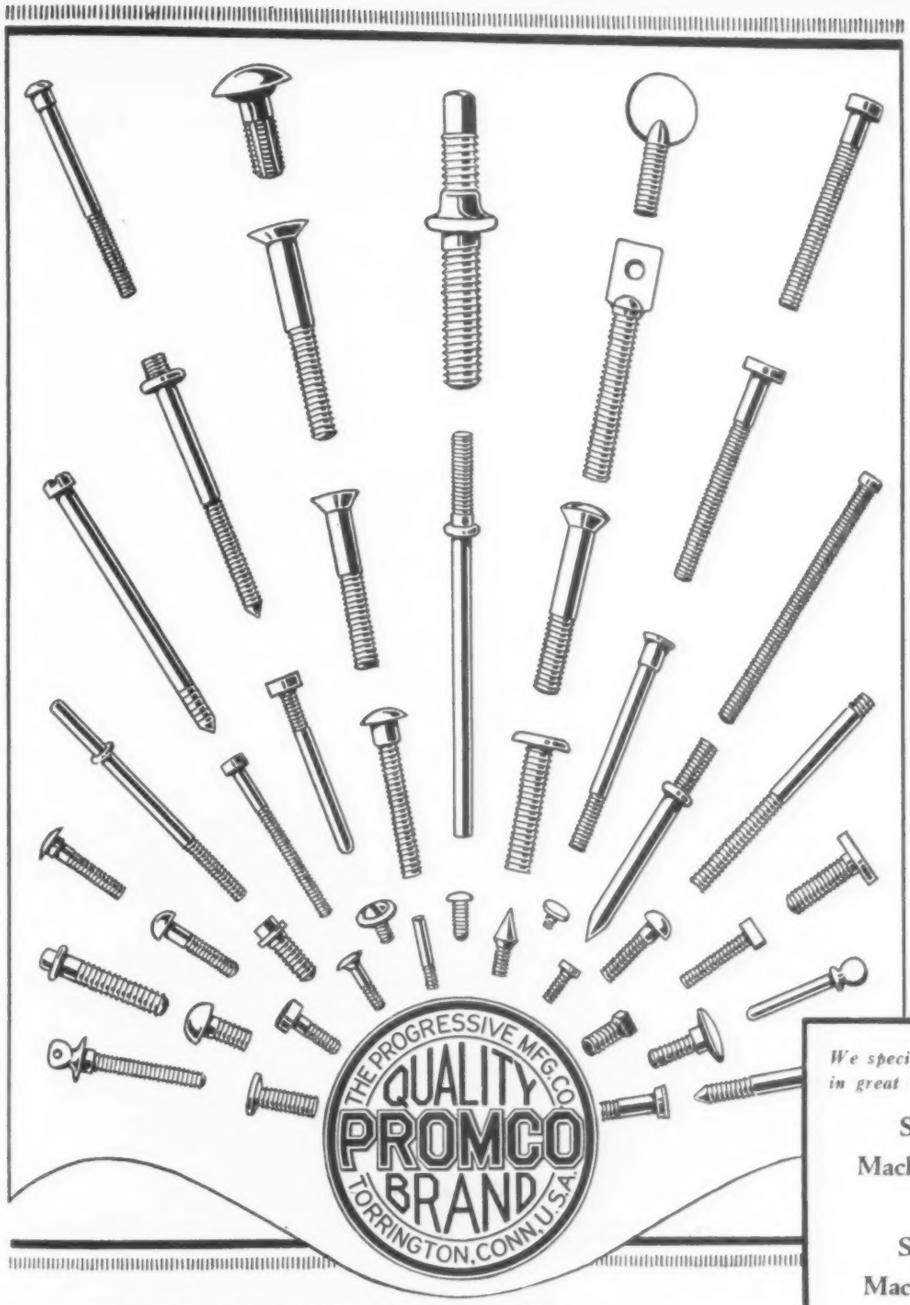
Rivets and wire nails are made to order only, in iron, brass, copper, nickel silver, aluminum, lead, Monel metal, Stainless Steel, etc.

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Bright Steel

Brass

Copper

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We specialize in and stock in great volume

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Compare our prices on cold headed products with those milled from the bar. By means of the most modern machinery we greatly lower the cost of all products that lend themselves to the cold heading process.

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There is a favorable cost comparison on all our products, and their uniformity of manufacture ensures you against slowing down in your assembly operations.

THE PROGRESSIVE MANUFACTURING COMPANY

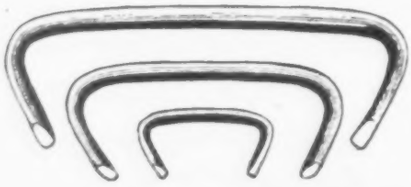
The House of Service TORRINGTON, CONN. *The House of Service*



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of STEEL, BRASS and COPPER, S. & C. OVAL POINTED BELT HOOKS and SPECIAL WIRE HARDWARE.



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We also Manufacture Metal Stampings

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Established 1887
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SPECIALTIES IN WIRE DRAWN FROM SWEDES IRON, BESSEMER, OPEN HEARTH AND CRUCIBLE CAST STEEL. SPECIAL WIRES FROM CARBON STEELS OF PARTICULAR ANALYSES. ESTABLISHED IN 1857
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OLD FASHIONS VERSUS THE NEW



Pat. Jan. 3, 1928

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The new, patented Kantlink spring lock washers do not tangle or interlink,—often they pay for themselves in time saved. They do not rust, and they have greater holding power.

Many large manufacturers have already adopted Kantlinks and are using them exclusively. Order some today and make your own test.

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High Carbon *Low Carbon*
Alloy Steel

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STRAIGHTENED AND CUT WIRE
WELDING WIRE
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STEEL MUSIC WIRE — WASHBURN WIRE CO. INC. N.Y. — EAGLE BRAND — 020

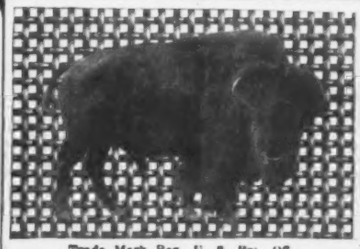
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"A BETTER WIRE CLOTH"

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Not down to a price.

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60 years of SERVICE

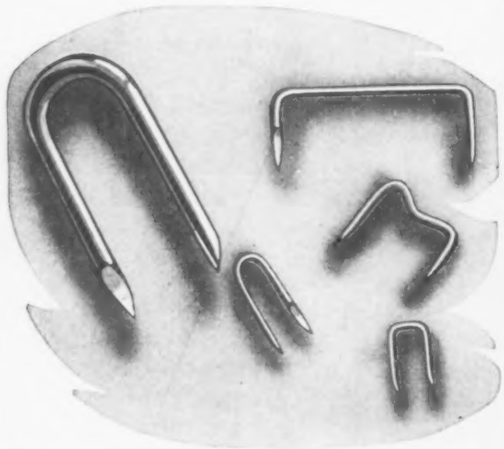
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This experience helps us to serve you right. Our large scale production means low costs - and prices that will interest you.



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STAPLES - long or short, made of 5/16" or 20 gauge wire.

For wire shapes and staples, write

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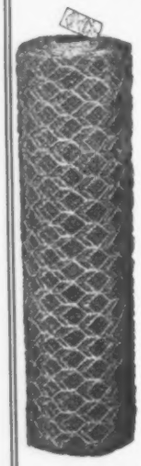
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Wire forms—any shape—any size—any quantity. We are prepared to give you prompt deliveries on accurately made pieces, in accordance with your specifications.

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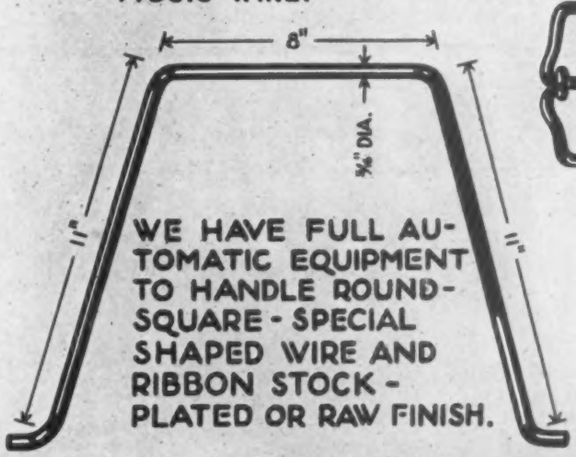
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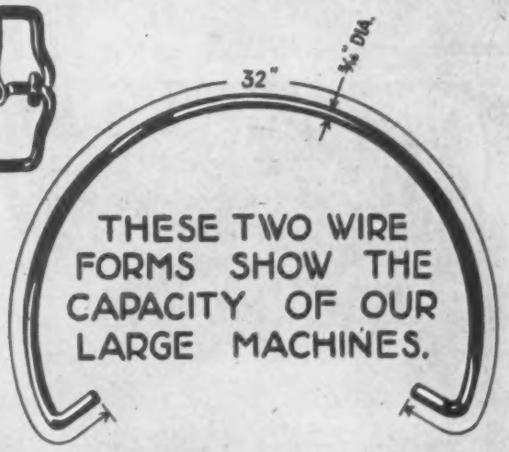
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THESE TWO WIRE FORMS SHOW THE CAPACITY OF OUR LARGE MACHINES.

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The turnbuckles with advantages.
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that says it all!
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Coiled and Flat Springs
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GOOD SPRINGS
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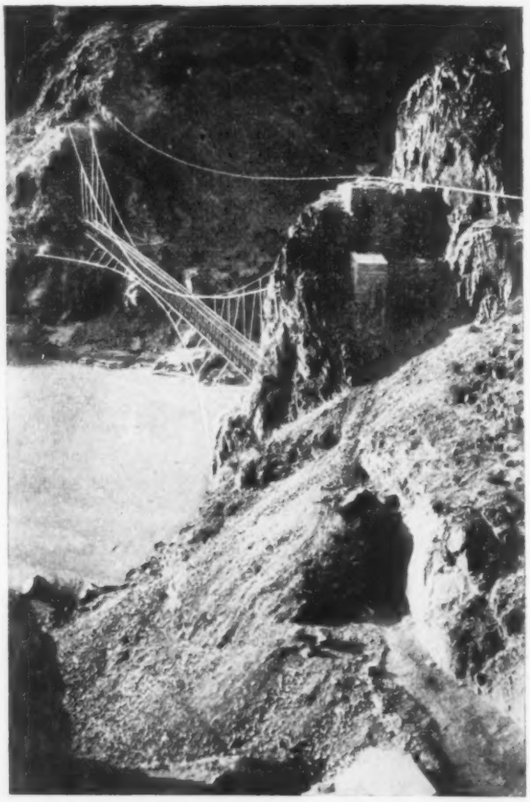
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Wire Rope and Wire are essential assets of our modern civilization—indispensable in every form of industrial life.

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crossing the Colorado River in the Grand Canyon of Arizona.

All suspension cables, wire rope and wire rope fittings used in the construction of this bridge were built by

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HAZARD ARMORED WIRE ROPE (GORE PATENT)—for use on operations where the service is particularly severe—such as Steam Shovels, Dredges, etc.

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WILKES-BARRE PENNSYLVANIA

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"HERCULES" RED-STRAND WIRE ROPE

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After all is said—results are what count, and it is on this basis that "HERCULES" (Red-Strand) Wire Rope continues to make and hold friends. Its strength and endurance insure safe, dependable and economical service. Made in both Round Strand and Patent Flattened Strand constructions in order to meet all working conditions. Your inquiries would be appreciated.



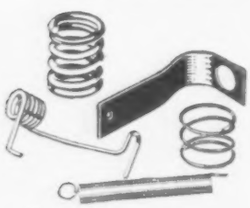
Always Made With — *One Red-Strand*

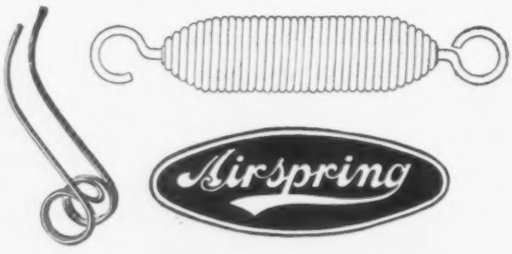
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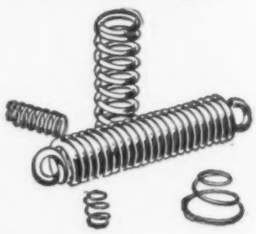
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Coiled wire springs and special shapes from Brass, Phosphor Bronze, Chrome Vanadium, Music, Hard Drawn or Oil Tempered Wire.

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Four Sizes
Capacities ½-oz. to 5-oz.
Weight 2-oz. to 6-oz.

Airspring

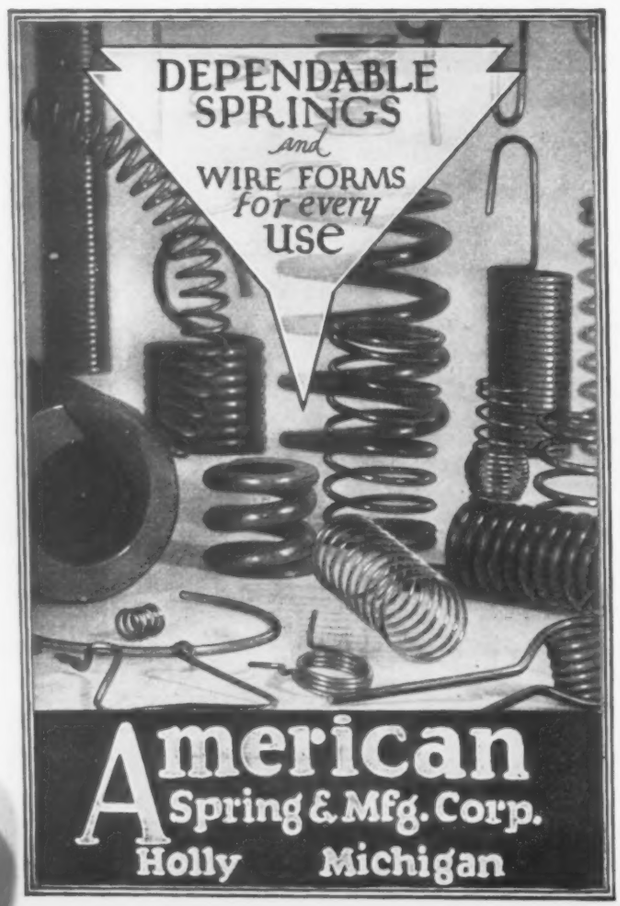
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Weight 2-oz. to 10-oz.

HUNTER PRESSED STEEL CO.

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LEE-BUILT TRADE MARK SPRINGS

EXTENSION COMPRESSION

TORSION FLAT

WIRE FORMS

SMALL STAMPINGS

All types, all sizes, all materials.

A reliable source of supply for dependable products

LEE SPRING COMPANY, INC.

30 Main St., Brooklyn, N. Y.





Springs in the Home–

There are lots of springs and special wire shapes in your home. Your sewing machine, vacuum cleaner, electric clothes and dish washer, your radio, toaster, iron—you could add a dozen or more to the list. All of them have springs or special wire shapes and on these parts rests the reputation of the manufacturer.

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CUYAHOGA SPRINGS and WIRE SHAPES

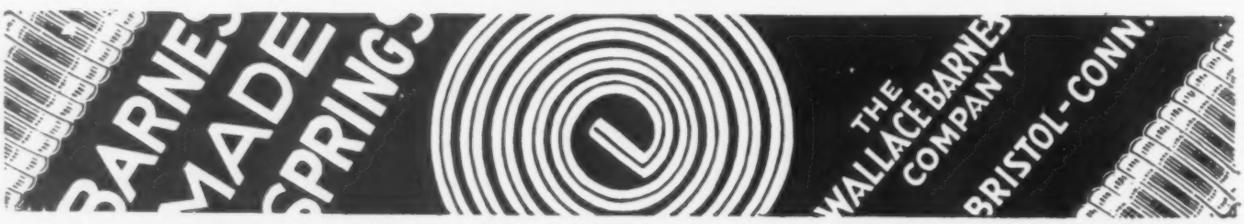
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ESTABLISHED 1905

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WELCH PATENT EXPANSION PLUGS
(For Closing Core Holes)
SPECIAL WIRE SHAPES SMALL STAMPINGS
WASHERS and SPRING COTTERS
Send blue prints or samples for estimates.
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SPECIFICALLY BUILT FOR SAFETY FOR AIRCRAFT
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AUTOMATIC OIL LUBRICATION
ALL CLASSES OF MACHINERY
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Careful workmanship
Prompt delivery



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OPERATE PICKLING BATHS PROFITABLY

RODINE

Saves Acid, Metal and Time

RODINE assures perfect pickling results, conserves metal; saves acid and time. Appreciably lowers costs. If your pickle tanks run profitably now, make them more so with RODINE.

Send for Bulletin No. 15

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Ambler, Pa.
General Offices and Factory

The Virtues of Aluminum Paint

Its flaky, shield-like surface, light-reflecting; heat-resisting; economy through high covering power (up to 400 sq. ft. per gallon) are at their best when mixed with our new and improved vehicle

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This remarkable vehicle has in itself unusual rust-resisting properties, which are enhanced and perfected by the accompanying aluminum powder. In the container shown at the left we supply the proper quantity of both vehicle and "albron" aluminum powder to make 5 gallons of highest quality mixed paint.

Write us for further information in regard to aluminum paint, varnishes, lacquers and special technical coatings.

A New, Scientific Way of Using Aluminum Paint

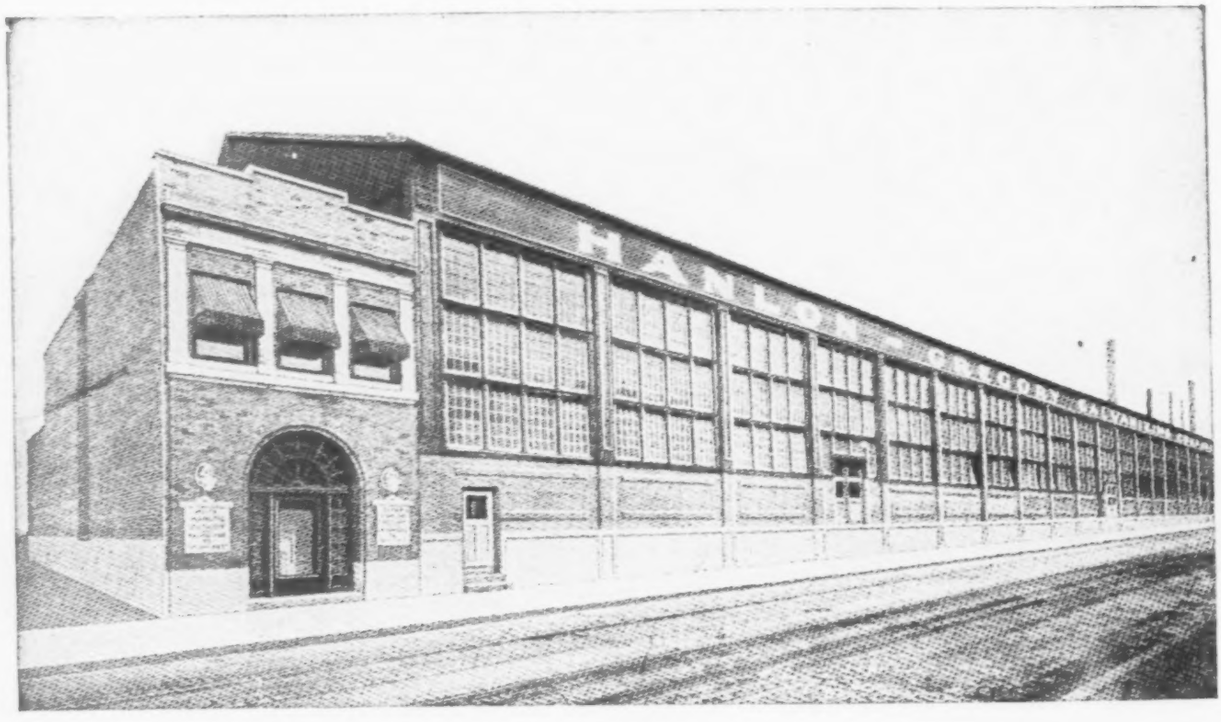


This special compartment container assures accurate mixing—*on the job.* Best results are had only by mixing when ready to paint.

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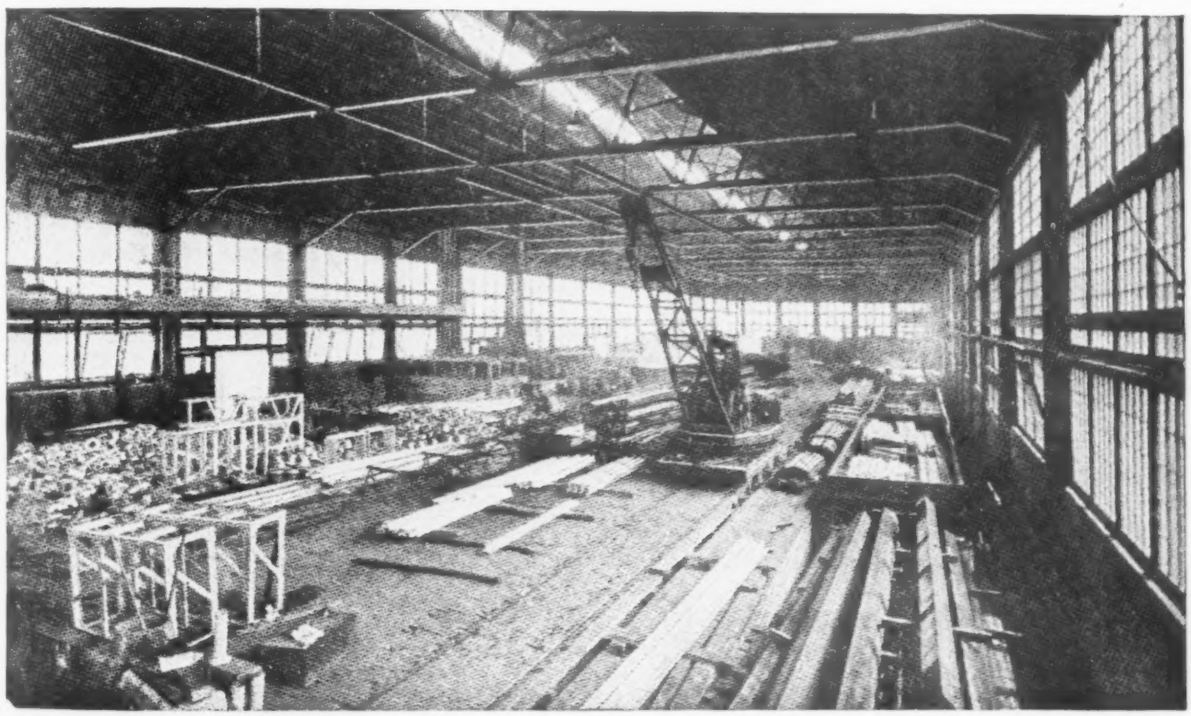


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"OLD FASHIONED HOT DIP"

Capacity 350 tons per day

GALVANIZING CO.
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Ready to Ship at a Moment's Notice



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Of course, we help him by maintaining a large stock of

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METAL CLEANER
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DRAWING COMPOUNDS

We suggest that you have our engineers study your product and recommend the right BRUKO COMPOUND or CLEANER for you.

We also make polishing wheels—a trial will convince you of their superiority.

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Made with adjustable Ball Bearings only.

Capacity 4" round iron in 10 minutes.

Hearth, 18 inches in diameter.

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Over a Million In Use

Write for No. 55 Catalogue on Blowers, Forges, Drills, Lathes, Grinders, Hack Saw Machines, Taps and Dies, Power Hammers, Ventilating Fans and Woodworking Machinery, etc.

CHAMPION BLOWER AND FORGE CO.---LANCASTER, PA.

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ANTHONY NEBULYTE OIL BURNING SYSTEM

A highly developed system of gas firing with oil fuel, 70,000 applications. Other systems quickly converted. Old burners easily replaced with NEBULYTE Oil and Gas burners. Installations everywhere.

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Hauck Venturi High Pressure Oil Burner
with and without Air Control Registers

Burn all light and heavy fuel oils with compressed air or steam at 30-lbs. or more as the atomizing agent. The fine oil atomization of these burners is responsible for the uniform and intimate mixing of oil and air resulting in high oil burning efficiency. Write us about your oil burning problems. We have and will recommend a burner to meet your requirements.

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"American" Electric Furnaces
for every industrial purpose

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Rotary Retort Continuous and semi-continuous

AMERICAN ELECTRIC FURNACE CO.
31 Von Hillern Street, Boston, Mass.

DETROIT
USED BY THE FOREMOST FOUNDRIES

ROCKING ELECTRIC FURNACES

ROLLING MILLS, SMELTERS AND REFINERS

Detroit Electric Furnace Co. 825 W. Elizabeth St. DETROIT, MICH.

Carburizing Hardening Annealing
FURNACES
HEAT TREATING FURNACES
for all purposes
We build the Furnace to Fit Your Job
Send for Bulletins



THE ELECTRIC FURNACE CO.
of SALEM, OHIO

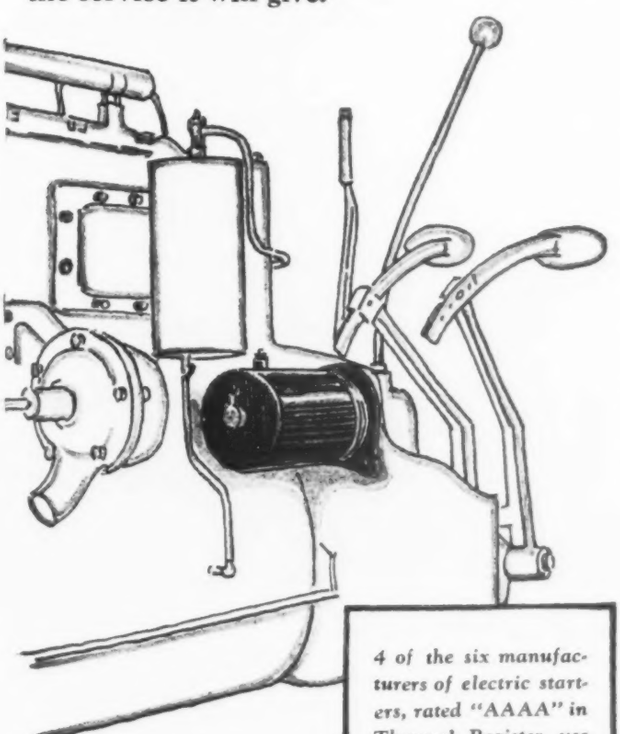
4 leading makers of electric starters

use OAKITE *cleaning materials!*

ELECTRIC starters must be made to withstand hard usage. Operated many times daily, their action must be unfailingly positive. Care in the manufacture of such a product is highly important in determining the service it will give.

For the necessary precision and thoroughness in their production cleaning, four of the country's leading manufacturers of electric starters have turned to Oakite materials and methods. In grinding, in anti-rusting, in the various cleaning tasks between operations, they have found, from experience, that Oakite materials can be depended upon for top-notch performance and maximum efficiency.

You, too, can profit by the improvement and economy that Oakite materials will effect in your plant. Our two booklets "Modern Metal Cleaning" and "Modern Cutting and Grinding" are full of practical information on these important subjects. Send for them. No obligation of course.



4 of the six manufacturers of electric starters, rated "AAAA" in Thomas' Register, use Oakite materials.

Oakite Service Men, cleaning specialists, are located in the principal industrial centers of the U. S. and Canada.



Please send me, *without obligation*, a copy of the booklet checked:

☐ MODERN METAL CLEANING
☐ MODERN CUTTING & GRINDING

Individual_____
Firm_____
Street_____ State_____
City_____

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Industrial Cleaning Materials and Methods

Manufactured only by
OAKITE PRODUCTS, INC., 20 Thames St., NEW YORK, N.Y.

NEARLY 20 YEARS EXPERIENCE SERVING 19000 CONCERNS IN MORE THAN 300 DIFFERENT INDUSTRIES

This Hagan Designed Electric Furnace Equipment Automatically Heat Treats an Axle Every Minute

A world renowned automobile manufacturer needed furnace equipment that would automatically anneal their front axles at 1600° F. for 50 minutes, harden at 1550° F. for 45 minutes and then draw for 65 minutes at 1200° F.

They put the problem up to Hagan. The result was the double end, pusher type Hagan electric furnace shown below fully automatic both in time and temperature control. Today this Hagan equipment is very satisfactorily heat treating an axle every minute in each furnace.

Hagan engineers are ready to tackle your particular furnace problem—any time—anywhere.

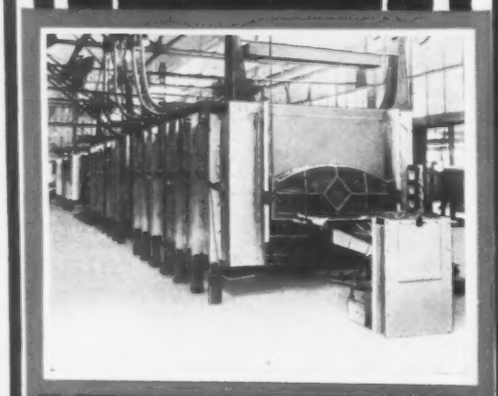
GEORGE J. HAGAN CO.
PITTSBURGH, PA.

CHICAGO
20 E. Jackson Blvd.

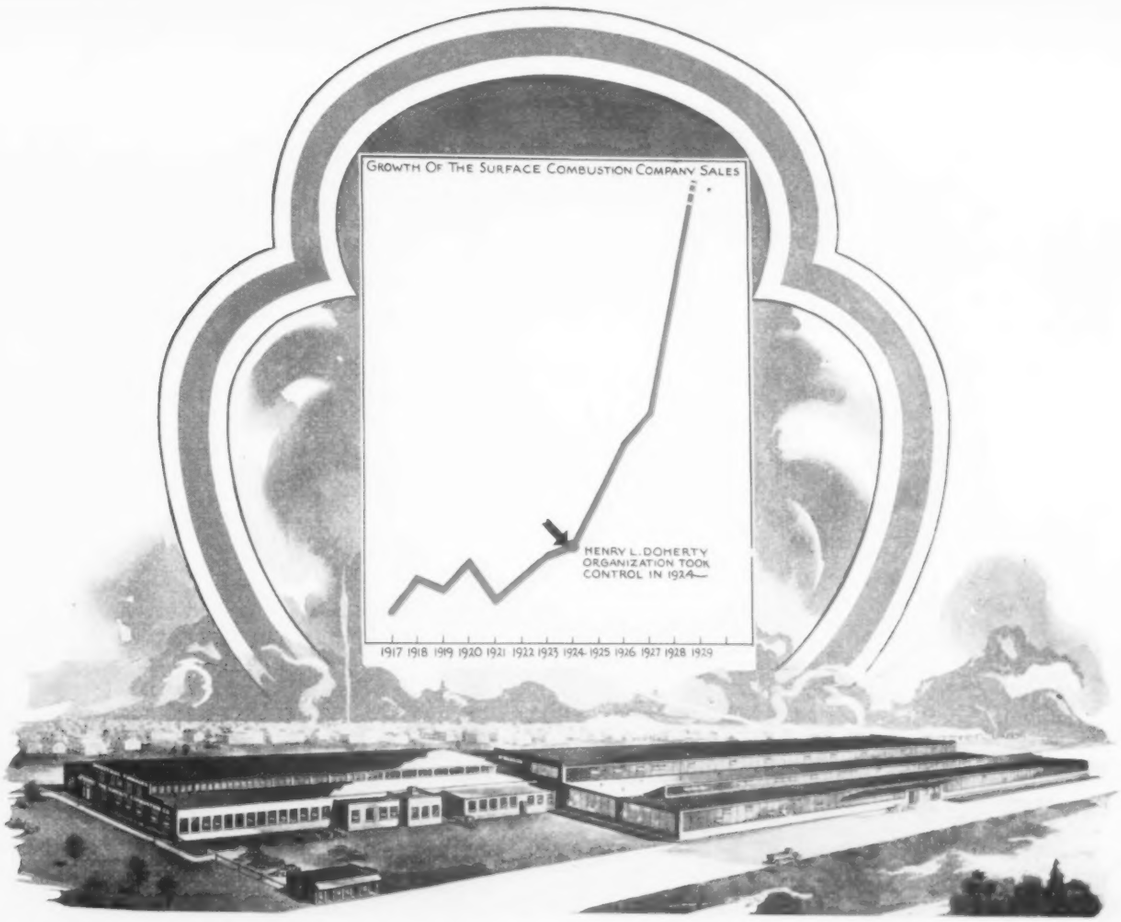
DETROIT
155 W. Congress St.

SAN FRANCISCO
273 7th Street

HAGAN FURNACES



INDUSTRIAL FURNACES FOR ALL PURPOSES
HAGAN



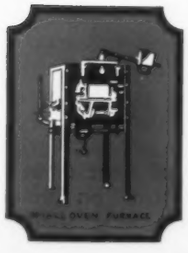
There is only one answer— SERVICE

It is with pardonable pride that we point to the "achievement curve" shown above—and its rapid rise since we have laid our plans upon the foundation of Service.

Service—first, last and always.

It is a Complete Service founded upon knowledge gained thru extensive and intensive research, backed by adequate resources to develop to the fullest degree the findings of research.

The application of S. C. service, to any furnace problem, is an assurance of obtaining equipment built to satisfactorily meet specific requirements, and to affect the greatest economy in the movement of materials in mass production thru heat treating operations.



The Surface Combustion Co.

INCORPORATED

Subsidiary of Henry L. Doherty & Co.

2375 DORR STREET, TOLEDO, OHIO

Branch Offices in All Principal Cities

Mantle Recuperator Division
METALLIC RECUPERATORS

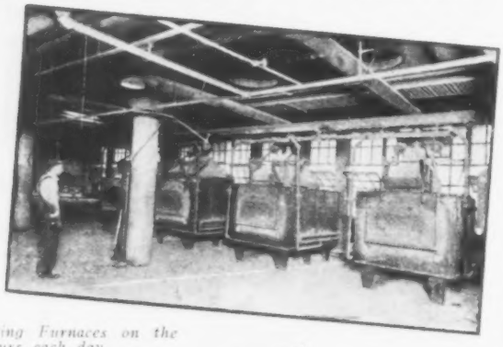
Webster Engineering Co.
WEBSTER BOILER BURNERS

Member of Industrial Furnace Manufacturers Association





Stewart Heat Treating Furnace in a large automobile manufacturing plant.



Stewart Carburizing Furnaces on the job 24 hours each day.

STEWART

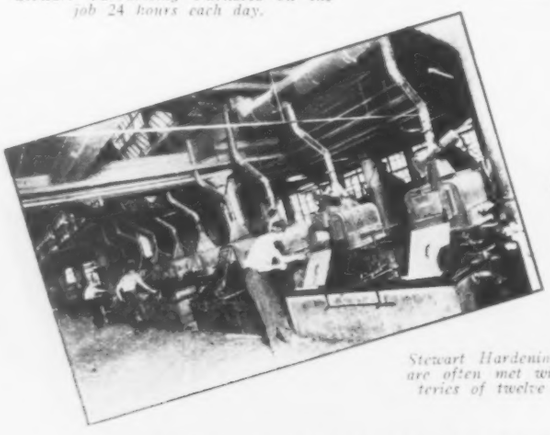
INDUSTRIAL

FURNACES

Stewart is a thorough-going, complete heat treating furnace. Besides furnaces for any heat treating requirements, we can supply a complete line of auxiliary equipment.

Every Stewart furnace is built to fit the job. Every possibility of waste is done away with. Correct design, control and construction save fuel and eliminate loss of time.

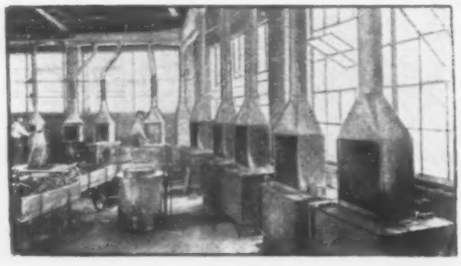
The Stewart Industrial Furnace Catalog is complete with illustration and construction diagrams. It also contains much material of value to any heat treating department. Send for one today



Stewart Cyanide Hardening Furnaces are dependable and built to last

Stewart Hardening furnaces are often met with in batteries of twelve or more.





Stewart Liquid Bath Furnaces in battery



Stewart High Speed Steel Hardening Furnaces at work.

40 years making industrial furnaces for every heat treating requirement has built up a stock of patterns which enables us to build to your special furnace specifications without extra pattern cost.

Stewart furnaces incorporate the most up-to-date heat treating engineering. They are guaranteed to do the work for which they are built and will do it with a saving in cost.

More Than 150 STEWART Types and Sizes

Expert consultation on matters regarding heat treating is always available. No matter what your heat treating problem may be, get in touch with our nearest office shown on the next page and a man experienced in selling the right furnace for the job and with a thorough knowledge of heat treating requirements will call on you promptly. No obligation to you—it's part of Stewart service.

STEWART

SERVICE FACILITIES

Branches for Stewart Industrial Furnaces are conveniently located throughout the country. Address the one nearest to you for prompt and complete service.

MR. J. W. LAZEAR,
225 Broadway, Room 1201,
New York City, N. Y.
Phone: Barclay 8082

MR. R. C. SCHWARZ,
943 Granite Bldg.,
Rochester, N. Y.
Phone: Main 2864

MR. P. R. GRAM,
211 So. Foster Ave.,
Lansing, Mich.
Phone: 8884

MR. PAUL SLADKY,
1738 Nineteenth St.,
Milwaukee, Wis.
Phone: Hopkins 3792

L. L. NELMS,
Wessendorff, Nelms & Co.,
317 Preston Ave.,
Houston, Texas.
Phone: Preston 3883

C. B. BACKCOCK CO.,
135 Bluxome St.,
San Francisco, Calif.

MR. HUGH L. DUNN,
2316 Locust St.,
St. Louis, Mo.
Phone: Chestnut 2960.

MR. HENRY G. HOSS
4805 Park Avenue,
Indianapolis, Ind.
Phone: Humboldt 4523

C. M. BIGGER CO.
332 Sycamore St.,
Cincinnati, Ohio.
Phone: Main 2140

WM. M. BAILEY CO.,
702 Magee Bldg.,
Pittsburgh, Pa.
Phone: Court 2041-2042

PFAFF AND BATHKE,
Pioneer Bldg.,
St. Paul, Minn.
Phone: Garfield 4012.

MR. R. B. HILLEARY,
1501 Heyburn Bldg.,
Louisville, Ky.
Phone: Highland 5932.

MR. M. S. BASKIN,
79 Milk St., Room 1009,
Boston, Mass.
Phone: Liberty 8518.

J. VAN BUSKIRK,
911 Martin Bldg.,
Birmingham, Ala.
Phone: 4-1370.

R. C. JORDAN,
1701 Arch St.,
Room 310, Wesley Bldg.,
Philadelphia, Pa.
Phone: Rittenhouse 6369.

CANADIAN BRANCH,
349 Carlaw Ave.,
Toronto, Ont.
Canada.

CHICAGO FLEXIBLE SHAFT COMPANY
Main Office and Factory
1146 So. Central Ave.
Chicago, U. S. A.

Double Deck High Speed Steel Furnace in Action



It pre-heats while it heats. Like all Stewart furnaces, rugged in construction, economical in use and long lasting. Scientifically correct.

Combustion takes place under the floor, and because of the high heat conductivity of carbofrax an even heat is assured throughout the furnace.

Built to meet the severe conditions required by the high temperatures necessary for the proper hardening of high speed steel.



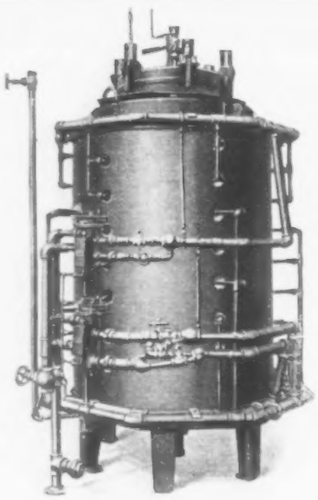
None Too Small—None Too Big

The great scope of Stewart Industrial Furnaces is best demonstrated by the fact that we serve hundreds of users of one or more of the small types of furnaces as well as a great many manufacturers requiring mammoth production.

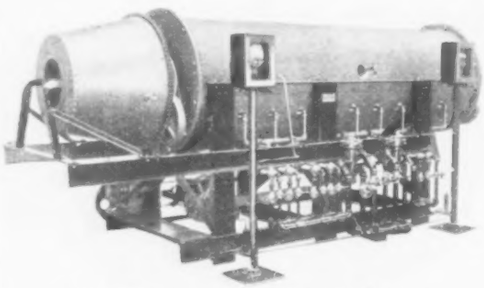
No matter what it may be, we would like the privilege of quoting on any heat treating equipment that you may require.

STEWART INDUSTRIAL FURNACES HELP MAINTAIN THE FAME of WRIGHT AIRPLANE MOTORS for UNSURPASSED DEPENDABILITY

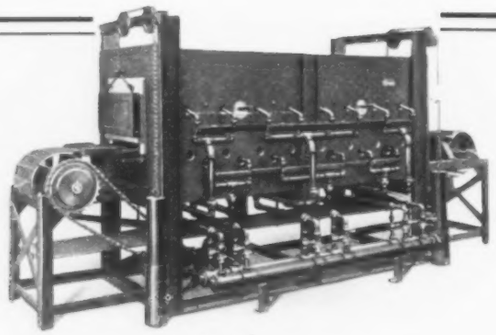
FIFTY YEARS



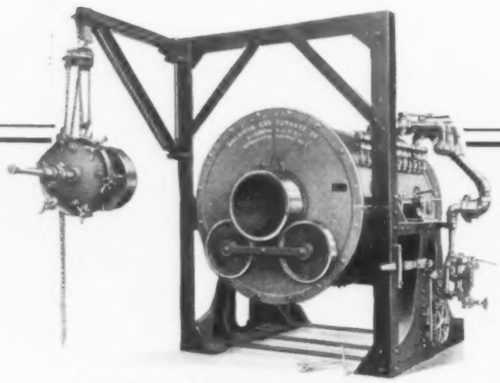
Parts, which cannot be rotated, such as gears, large races, shafts, etc., are carburized in Vertical Retort Furnaces because of uniformity of results, elimination of packing and overall reduction in cost.



Rotary Retort Continuous Heating Machines, in various sizes, find application because of reduction in labor charges and uniformity of results.



Mesh Wire Belt Conveyor Type Heating Machines are supplied for a wide variety of applications such as hardening, annealing, tempering, also for enameling.



Rotary Retort Carburizers, using either gas or compound for carburizing, are, today, generally being used for balls, rollers and races for anti-friction bearings, chain and chain parts, etc., because of the uniformity of results and low costs.

AMERICAN GAS FURNACE CO. FIFTY YEARS of INDUSTRIAL HEATING ACHIEVEMENT ELIZABETH, N.J.

AMERICAN GAS FURNACE CO. PIONEERS IN 1878 LEADERS TO-DAY

Makers of

Automatic Heat Controllers
Automatic Quenching Tanks
Blowpipes or Blow-Torches, Hand and Stand
Blowers
Boosters, Gas
Brass Melters
Brazing Furnaces and Tables
Burners
Burners for Electric Lamp Bulb Manufacture
Carburizing Machines
Cyanide Furnaces
Cylindrical Furnaces
Forges: Forges, Glass Bending
Heating Machines: Melting Furnaces
Muffle Furnaces
Oil-Tempering Furnaces
Oven Furnaces
Rivet Heaters
Soft Metal and Lead Hardening Furnaces
Textile Appliances for Singeing, Calendering, Tentering and Drying
Tube-Heating Furnaces
Every Type of Gas Blast Burner, Furnace and Heating Machine for Industrial Use.

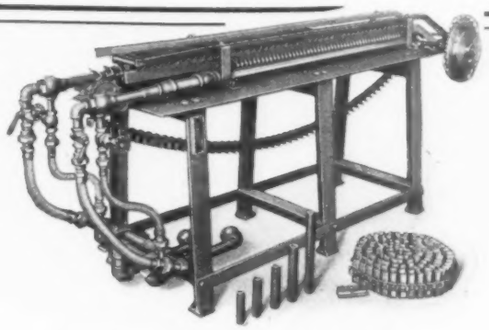
American Gas

Elizabeth,

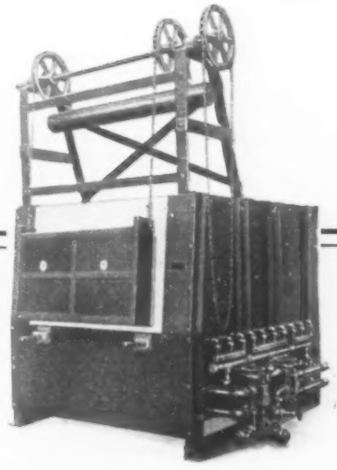
and still Pioneering

"American" engineers continue to lead the way, after more than fifty years of pioneering, in the research and development of modern industrial heating equipment.

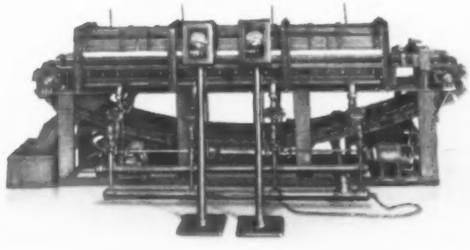
American Gas Heating Equipment has long been recognized for the superior results and savings in operating and maintenance costs. This is proved by repeat orders from many large companies such as the Timken Roller Bearing Company, International Harvester Company, Singer Sewing Machine Company, Chevrolet Motor Company, and many others.



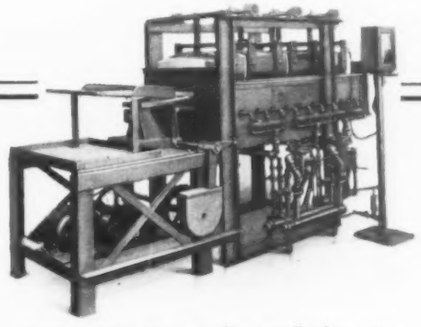
Burner Type Heating Machines find application in the local annealing, tempering and hardening of typewriter bars, tubes, small stampings, knife blades, etc.



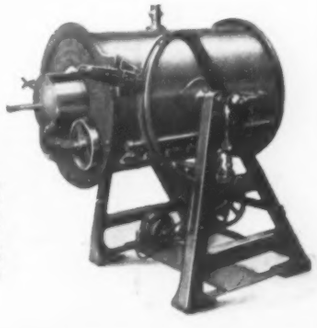
"American" Oven Type Furnaces are of advanced design. They are well insulated, lined with best grade refractories and equipped with burners that permit accurate combustion control.



Special Heating Machines for quantity production on a particular part are designed according to requirements. Your problem, if submitted to us, will receive prompt and careful consideration.



Parts ranging from needles, small pins, etc., up through a wide variety of springs, stampings, ball races and heavy pins are satisfactorily handled in this Reciprocating Hearth Heating Machine.



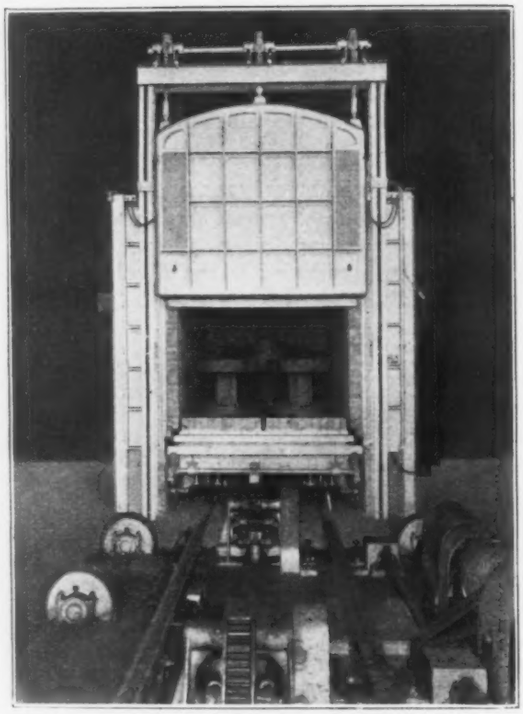
For tempering, also for obtaining various temper colors and applying "Carbonia" or Gun Metal Finish, Rotary Retort Low Temperature Machines are supplied.

Furnace Co.

New Jersey

SERVING AN INDUSTRY

FOR 18 YEARS HEVI-DUTY FURNACES have been identified with the metal working industries. For every heat treating process there is a HEVI-DUTY furnace



CAR BOTTOM ANNEALING FURNACE. Furnace car discharged by transfer car from either end.

TOOL ROOM AND PRODUCTION LINE FURNACES

THE AC_2 INDICATOR.—A device adapted to Hevi-Duty furnaces that indicates when steel passes through the critical range.

INDUSTRIAL BOX TYPE.—Sixteen standard sizes. Uniform temperature from 6 sided heat. Heats from cold to 1550° F. in 1¼ hours.

INDUSTRIAL POT TYPE.—For lead and salt heat treating. Highest economy. Cyanide hardening, 8 pounds per Kilowatt hour.

CONVEYOR.—For miscellaneous small parts. Floating type mesh conveyor. Eliminates belt distortion and wear. Unusual productive capacity, 1000 pounds per hour at 1550° F. from unit 12 feet by 1½ feet hearth area.

ROTARY RETORT CARBURIZER.—Electric—1000 and 750 pounds standard sizes. A practical production furnace evolved from four years field development. Close automatic temperature control throughout retort produces amazingly uniform case with profitable operating costs.

NITRIDING.—Forced circulation type. Designed to meet all peculiar requirements of the process.

AIR DRAWING.—Forced circulation type.

CAR BOTTOM.—Distinguished by the use of car bottom heat (patented) and lifting sand seal.

ROTARY HEARTH.—The use of heating elements in the hearth (patented) providing highest economy. When hardening at 1575° F. a production rate of 12 pounds per Kilowatt hour prevails.

BRIGHT ANNEALING.—Hydrogen and water seal types.

Miscellaneous.—COUNTERFLOW RECUPERATIVE—PIT TYPES—AUTOMATIC MATERIAL HANDLING—QUENCH TANKS—etc.

HEVI DUTY ELECTRIC COMPANY

MILWAUKEE, WISCONSIN

BOSTON NEW YORK BUFFALO CLEVELAND CHICAGO
DETROIT ST. LOUIS LOS ANGELES ST. PAUL

MOORE RAPID

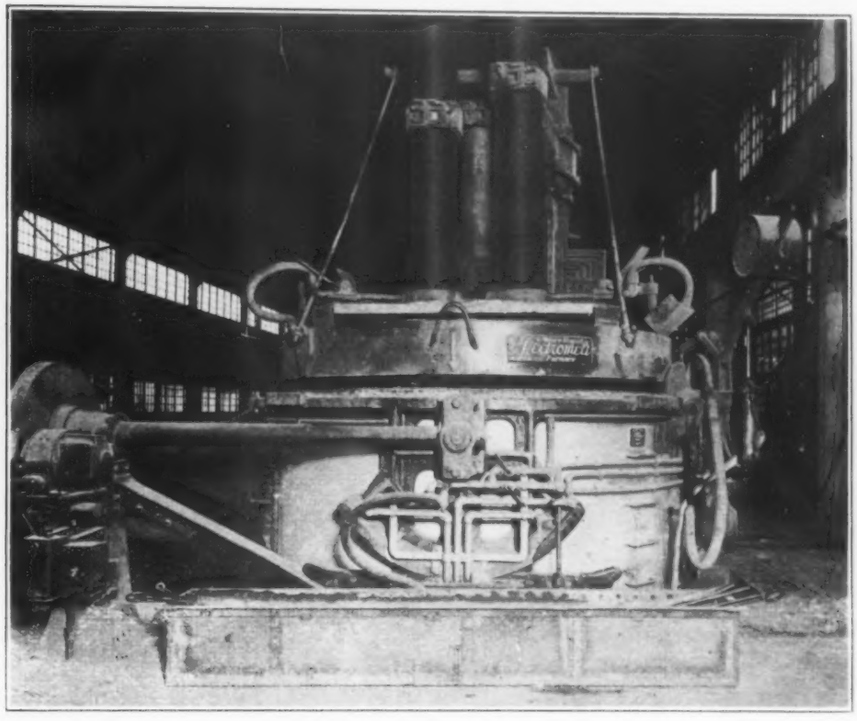
'Lectromelt

FURNACES

RELIABILITY

EFFICIENCY

THE MOST RAPID AND ECONOMIC FURNACE ON THE MARKET FOR THE PRODUCTION OF GRAY AND MALLEABLE IRONS, ALLOY AND CARBON STEELS



RECENT LARGE 'LECTROMELT INSTALLATION

The above illustration shows a 20-ton capacity 'LECTROMELT furnace with standard top charge rig with the roof just raised slightly, previous to being swung to one side for conveniently and quickly charging the furnace with a drop bottom bucket.

'LECTROMELT furnaces are built in standard sizes from 50 tons down to 50 lbs. per hour.

'LECTROMELT furnaces are ruggedly and sturdily built to withstand long, hard steel plant and foundry service.

ASK 'LECTROMELT USERS GET THE FACTS

Pittsburgh Electric Furnace Corporation

Pittsburgh, Penna.

AJAX NORTHRUP

ELECTRIC FURNACES

Remelt Stainless Steel Scrap

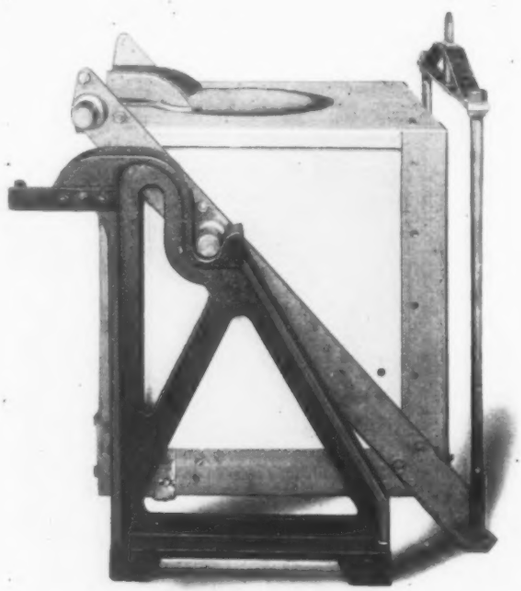
Without Carbon Pick-up or Loss in Chromium or Nickel

Carbon-free Melting

Excellent Mixing

High Efficiency

Rugged Design



Low Melting Losses

Rapid Melting

Excellent Working Conditions

Temperature Control

Standard 600 lb. Nose Tilting Furnace

Write for information

Ajax Electrothermic Corporation
Trenton, New Jersey

G. H. Clamer, President.

E. F. Northrup, Vice-President and Technical Adviser.

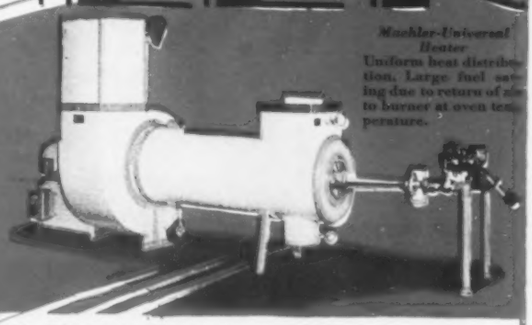
MAEHLER

1928

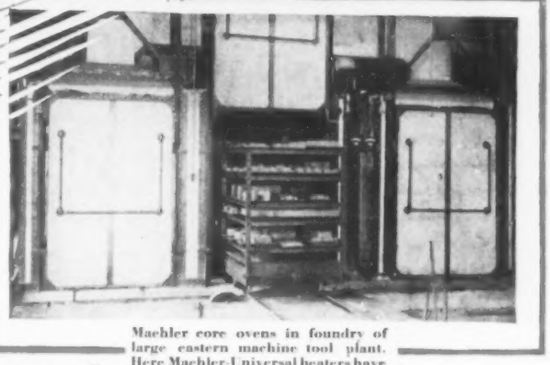
1929



Part of Maehler equipment at Lyon Metal Products, Inc. These monorail, truck loading type ovens give a fine, uniform finish in baking enamel on steel furniture parts.



Maehler-Universal Heater
Uniform heat distribution. Large fuel saving due to return of air to burner at oven temperature.



Maehler core ovens in foundry of large eastern machine tool plant. Here Maehler-Universal heaters have cured core baking troubles and boosted production to 96 tons per day.

1930

ANOTHER YEAR brings another new record

STANDARDS of industrial oven operation have been revised sharply upward within the past two years—a significant trend in view of the excellent results achieved during that time by the Maehler-Universal Heater.

This is the heart of a system for maintaining uniform oven conditions by recirculating convected heat. When announced in 1928, it had already shown superior performance in lithographing ovens. Its wide-spread success in new applications proved the value of Maehler heating methods. In less than a year, the Maehler-Universal heater won its way into the enameling, drying and baking fields.

On test runs, it showed 28% higher efficiency than radiant-type heaters and 40% higher than oil. It gives a super-degree of oven safety, due to the incineration of combustibles by passing the process vapors back through the burner zone.

The story of 1929—greatest year in Maehler history—is a recital of new installations and repeat orders for Maehler-built ovens and heaters. The list of Maehler-equipped plants, opposite, indicates that Maehler-Universal Heaters play a major part in the expansion programs of the country's leading concerns.

A newcomer in 1928—yet this Maehler-Universal system enters 1930 with a veteran record of success. It will contribute to your prosperity, for years to come, if you modernize your present ovens with Maehler-Universal Heaters, or install complete Maehler industrial ovens.

The coupon will bring you a copy of "Heat from Hazard," explaining this new and super-safe heating system.

Recently completed Maehler installations

General Motors Corp.
National Lead Company
Grigsby-Grunow Corp.
American Brake Materials Corporation
Pines Winterfront Corp.
Brown & Sharpe Mfg. Co.
Lyon Metal Products, Inc.
Motor Products Corp.
Stewart-Warner Corp.



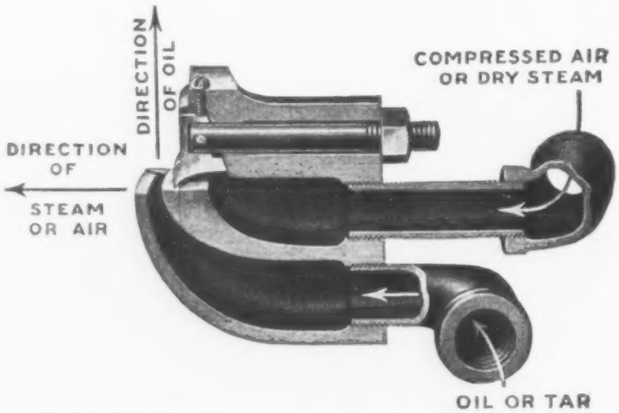
THE PAUL MAEHLER COMPANY
2208 W. Lake Street, Chicago, Illinois

Universal Economy

OVENS

PAUL MAEHLER CO., 2208 West Lake St., Chicago, Ill.
Gentlemen: Send information on Maehler industrial ovens and heaters for application on
☐ Enameling and Japanning ☐ Core Baking
☐ Process Drying
Also send copy of "Heat from Hazard" to
Name
Firm
Address
City State

For Low Fuel Cost
Specify
W. N. BEST Oil Burners



W. N. BEST High Pressure Type Oil Burner

When such well known concerns as General Electric, New York Central, Bethlehem Steel, Ford, Midvale, etc., use W. N. BEST Oil Burners they must combine efficiency and economy.

There are over 80,000 in use, and every one has been a revelation to its owners in the way of low fuel cost.

Let our Engineering Service Department show you how to successfully meet every industrial heating requirement.

Write for catalog.

Used in 25 countries and on every continent

W. N. BEST Corporation

Engineers and Manufacturers Since 1890

295 Fifth Ave. **New York City**



GREENE ELECTRIC FURNACES

Pioneers in the modern development of electric melting furnaces and processes for melting and refining iron and steel. Electric furnaces for all metallurgical purposes.

Descriptive literature prices, specifications or consultation upon request.

GREENE ELECTRIC FURNACE COMPANY

Furnace Builders and Consulting Engineers

165 Broadway, New York, N. Y. | 182 Fifth St. Berkeley, Calif. | 1918 Second Ave., S. Seattle, Wash.

ROCKWELL FURNACES
ELECTRIC *and* FUEL

W. S. ROCKWELL COMPANY — NEW YORK DETROIT — CHICAGO MONTREAL

DRYING OVENS
WASHING MACHINES for METAL PARTS

We also make a complete line of Baking, Enameling and Lacquering Ovens. Write for information.

DETROIT SHEET METAL WORKS

1298 Oakman Blvd. Detroit, Mich.

AUTOMATIC FURNACE EQUIPMENT — *Oil or Gas*
HARDENING, DRAWING, ANNEALING, CARBURIZING

McCann ~ Harrison Corporation

CLEVELAND, OHIO

"Greater Production, More Uniform Quality of Hardening"

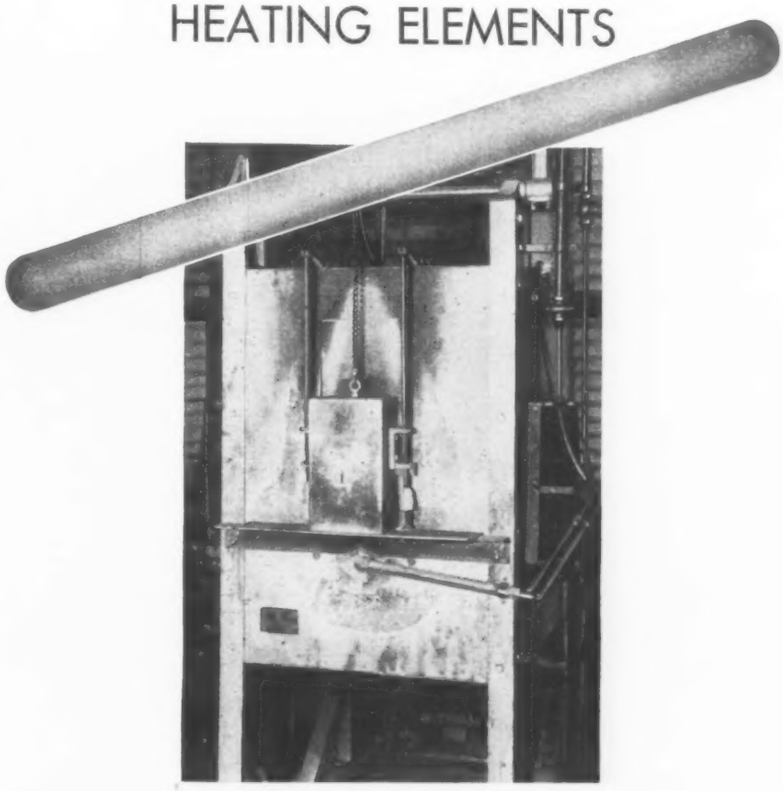
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NON-METALLIC ELECTRIC HEATING ELEMENTS



IN the plant of the Morse Twist Drill and Machine Co.—famed makers of twist drills—Globar Brand Electric Heating Elements are consistently emphasizing their efficiency. Eight of these elements are used in a specially designed C. I. Hayes Furnace for hardening Morse High Speed Steel Drills.

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Globar is the registered trade name given to non-metallic electrical heating and resistance materials, and to other products of Globar Corporation, and is its exclusive property.



There's Probably More Hidden Wealth In Your Plant Than In Captain Kidd's Treasure!

HOLCROFT

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But you won't find it in coffers or pieces-of-eight. You'll probably find it leaking away in pennies and dollars (that's the insidious thing about inefficient heat treating equipment)! Nor will you find it all in the excess consumption of fuel.

The place to look for it is in the tool room in broken and prematurely dulled cutters . . . in worn out, overtaxed machinery . . . in spoiled work . . . in rejected material, after it has passed previous operation inspections . . . You could add a dozen more places in your own shop!

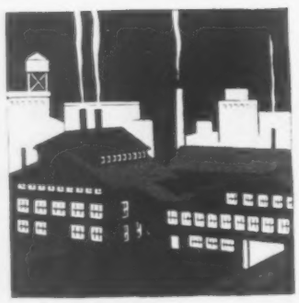
Why not get to the source of all these troubles? Let a Holcroft Engineer give you the actual facts on your heat treating equipment—even if it hurts, temporarily. The chances are that the new equipment, if you need it, will pay for itself in much less time than you suppose.

P. S.—The type of fuel you use won't make any difference.

& COMPANY

Home Office: Detroit—Branches: Chicago, Philadelphia; Canada: Hiram Walker & Son, Metal Products, Ltd., Walkerville, Ont.

CONSIDERATIONS BEFORE BUYING AN OVEN..



WHAT OF THE OVEN BUILDER'S ORGANIZATION

THE hiring of an unskilled laborer is done pretty much on outward appearances but when it comes to hiring a general manager, building a new plant or installing a piece of major equipment such as an oven, good business judgment requires a careful investigation of the prospective manager, the contractor, or the oven builder. Stability, integrity and ability are scrutinized rather carefully.

Consequently, if you are ready to install an oven, keep in mind these facts relative to the company whose signature appears below:

1. Company has maintained a steady growth since 1896.
2. Has pioneered most of the important improvements in oven design and oven practice since 1896.
3. Has national representation and international reputation.
4. Representatives are thoroughly experienced industrial engineers able to handle oven problems and make recommendations on the ground.
5. Company maintains at headquarters a complete Engineering Division to handle design problems from the initial survey to the final plans and specifications, and a field organization to supervise erection and make final operating tests.
6. Company operates a completely equipped manufacturing plant for the fabrication of oven parts by the most economical methods known today.
7. Company assumes full responsibility for the final results and efficiency of each installation in accordance with its initial recommendations.
8. Maintains contact with the oven user after the oven is in operation to insure proper handling and maximum economy.
9. During 1928 and 1929 supplied ovens to all lines of industry.
10. In 1928 secured orders in 45.6% of all oven negotiations concluded, which covers practic 'y every installation of any importance in this country.

You may have the benefit of the combined experience of this organization in the handling of your oven installation by sending a list of your requirements to the nearest Young Brothers representative.

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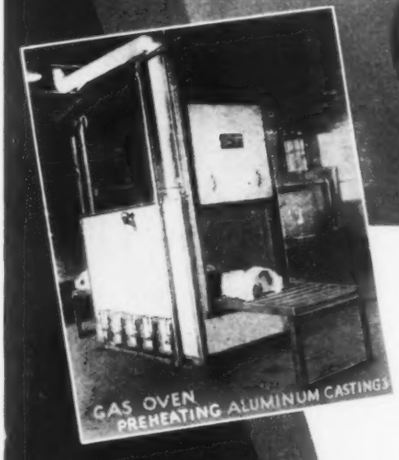
OVENS FOR

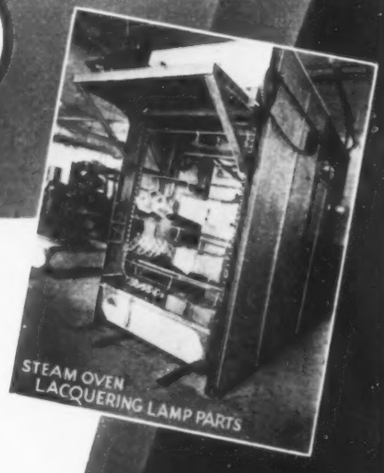
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Serving All Industries Rendering Improved Performance

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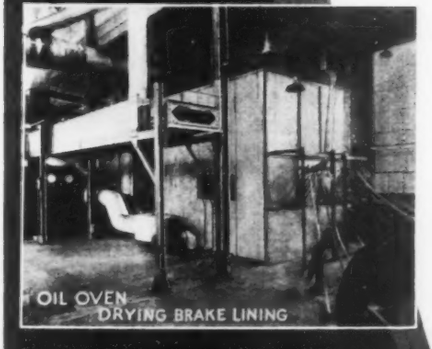

GAS OVEN PREHEATING ALUMINUM CASTINGS

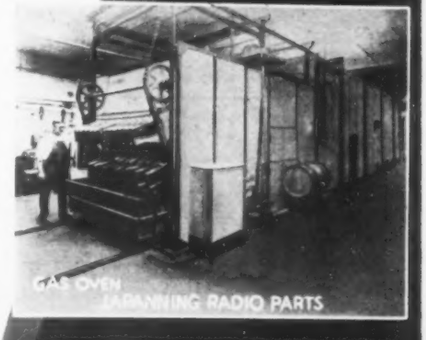

STEAM OVEN LACQUERING LAMP PARTS

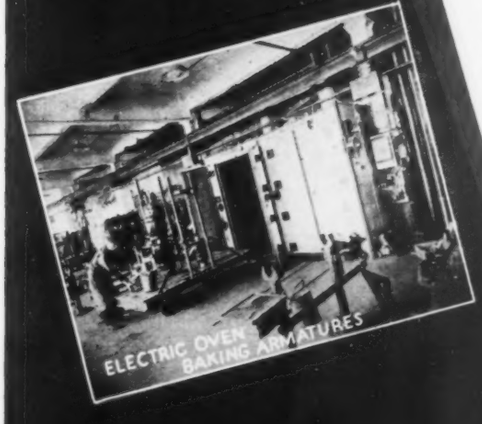
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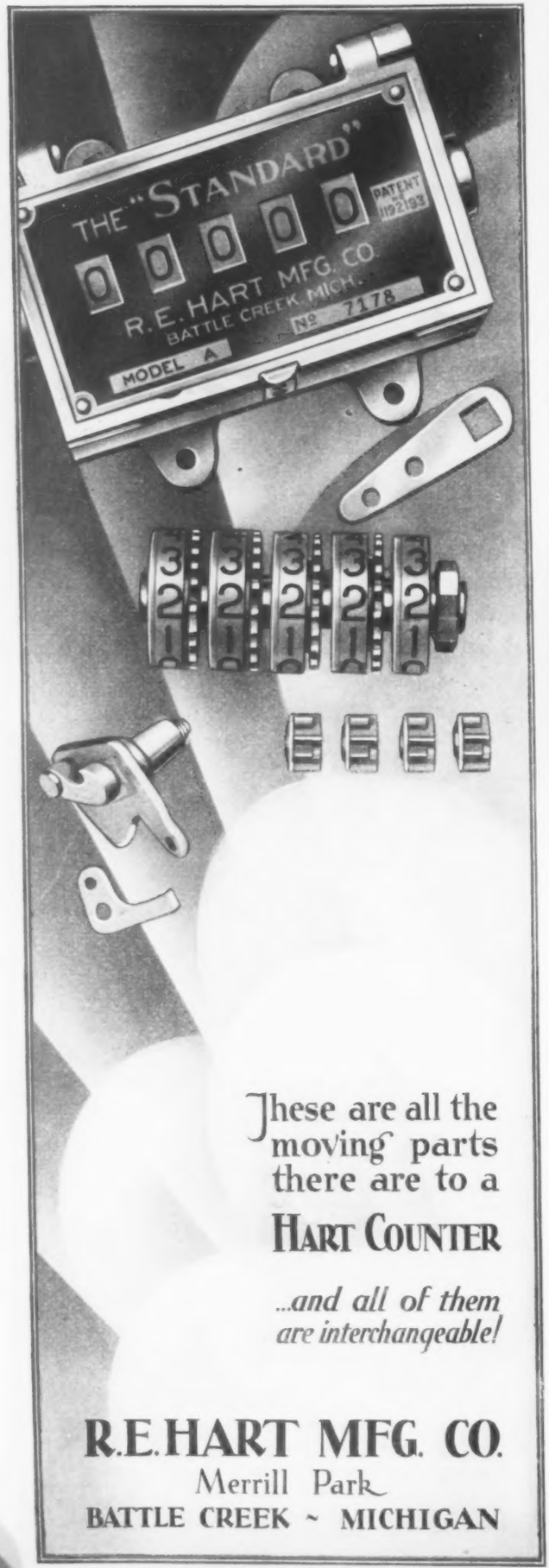

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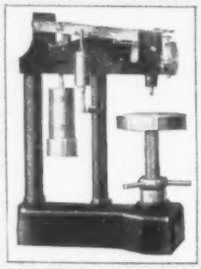
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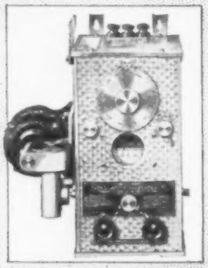
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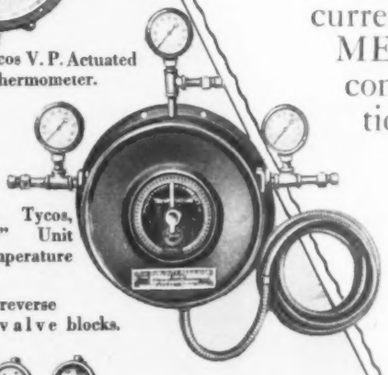
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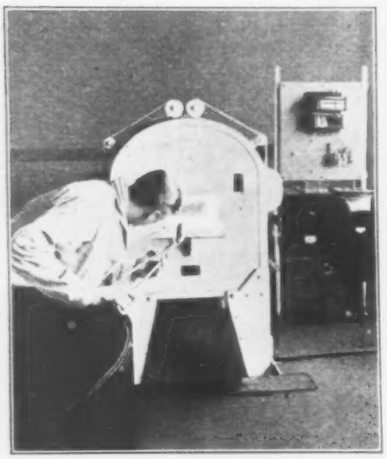
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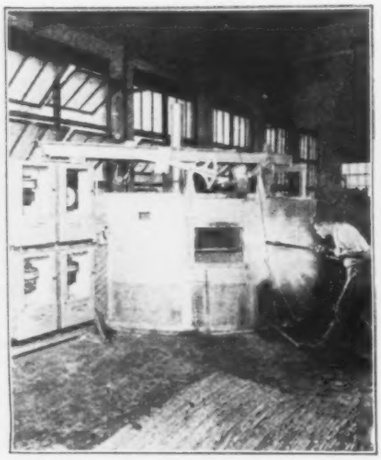
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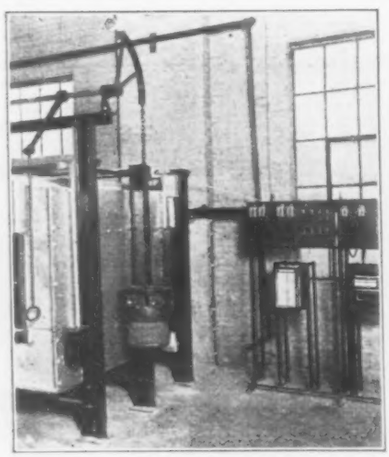
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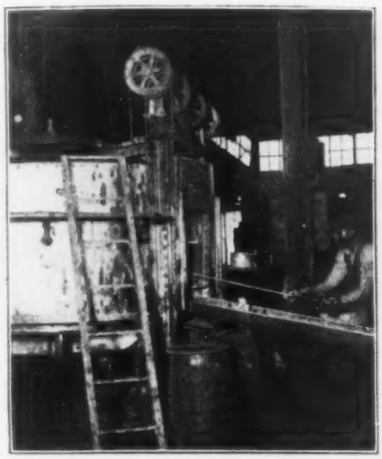
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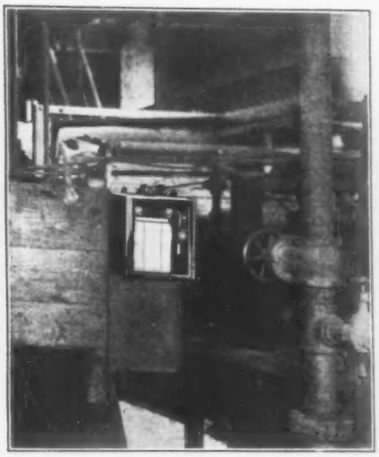
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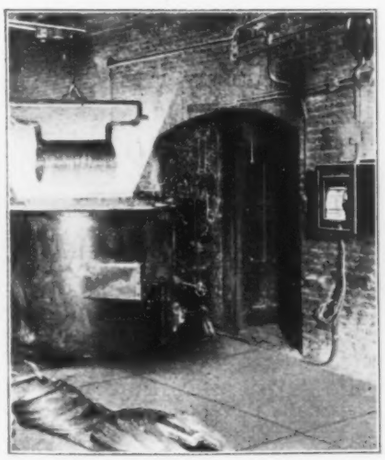
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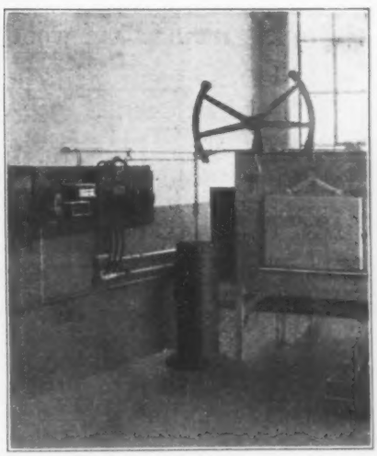
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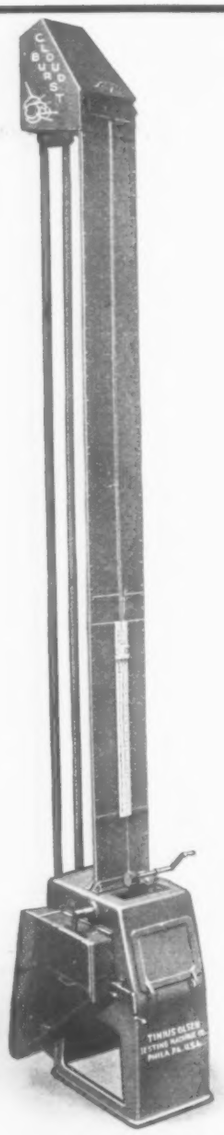
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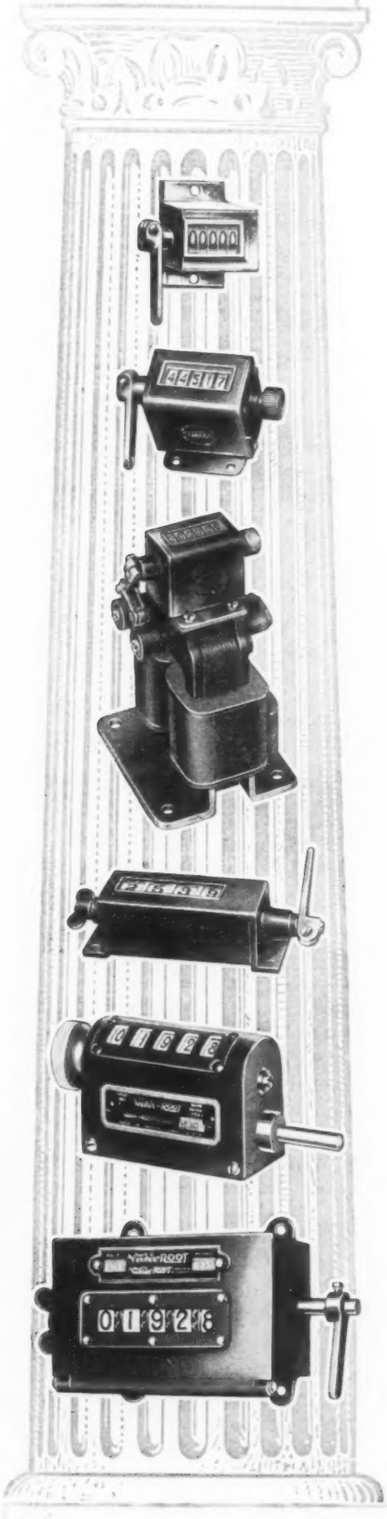
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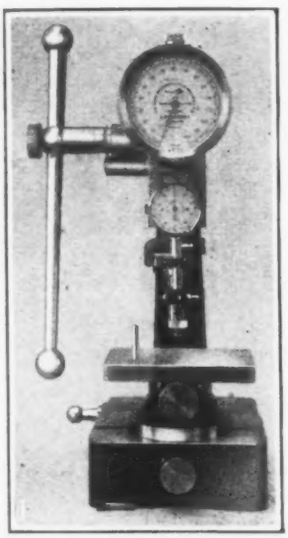
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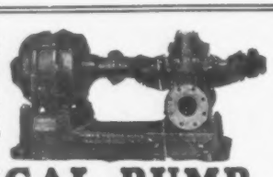
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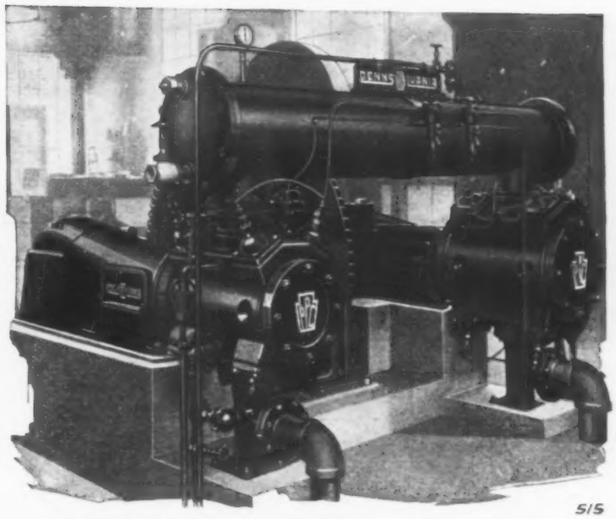
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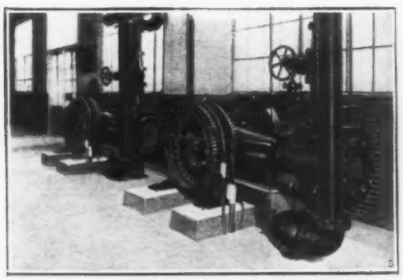
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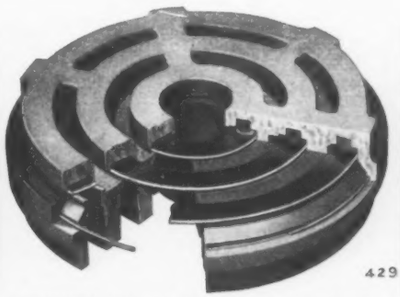
AIR CUSHION VALVE EQUIPPED

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PENNSYLVANIA, Synchronous Motor driven, Duplex Two-Stage Air Compressor.

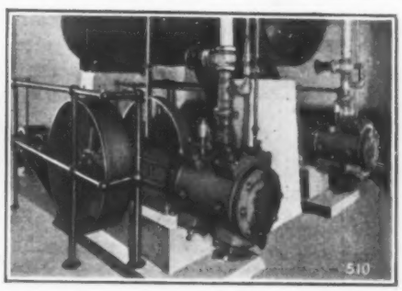


PENNSYLVANIA Single Stage Compressors, directly connected to Synchronous Motors.



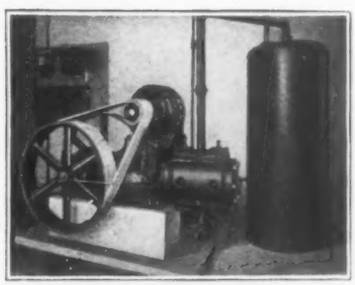
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PENNSYLVANIA Air Cushioned Valve. Neither a bolt nor screw in entire construction. Valve discs and springs of stainless steel.

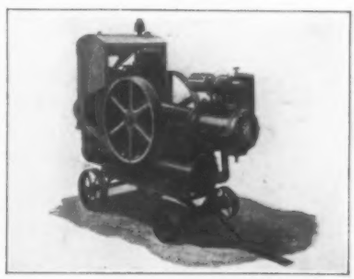


510

PENNSYLVANIA Single Stage Compressors equipped with short belt drive.



PENNSYLVANIA Single Stage Compressor, Multiple Belt Driven.



PENNSYLVANIA Single Stage Compressor, self-contained portable type, multiple belt driven from gasoline engine.

Exceptional care in design—the use of highest quality materials—superior workmanship, makes it possible for us to guarantee to every user of PENNSYLVANIA Air Compressors the maximum of dependable service.

Pennsylvania Pump & Compressor Co.

Main Office and Works, Easton, Pa.

Sales Representatives in Principal Cities

They Recognize the Name MYERS as a Mark of Superior Quality on Pumps and Water Systems

FIG. 2299



FIG. 1478

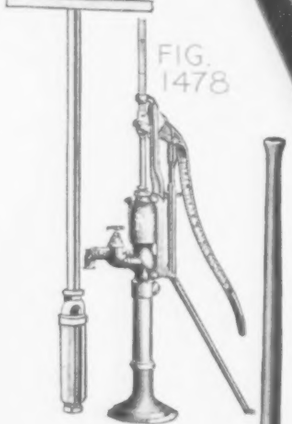


FIG. 1895

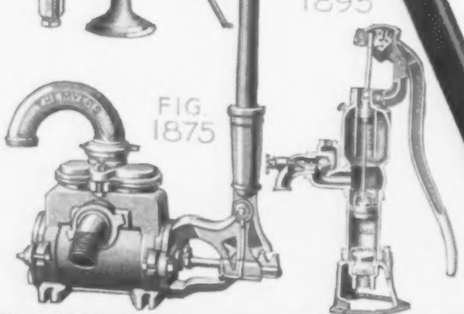


FIG. 1875

At times water may be a dry subject to you but when the supply becomes low, or the old pump is worn out, or when you are building or expanding your plant, or live in the country or suburban area, or vacationing at your summer home, your water supply becomes of utmost importance.

This is the time to remember the name MYERS and the complete line of superior quality pumps it represents—to remember that there is a dependable Myers Pump for any purpose up to ten thousand gallons of water per hour—hand and windmill, well house and cistern pumps—pump stands and tank pumps—hand and power water systems—self-oiling power pumps and pumping jacks—cylinders and power working barrels—tens of thousands of which have been in service the world over for from five to forty years and longer.

If you have water problems to solve either at home, farm or factory or any other place where reliable water service is essential, write us for catalog. And should you require special information address our Engineering Department.

FIG. 2534

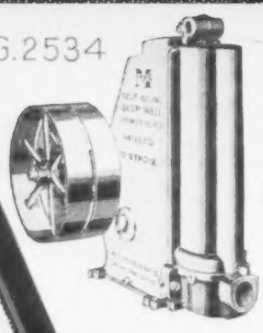


FIG 2346

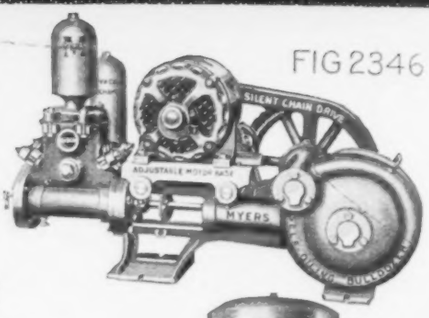


FIG 2549

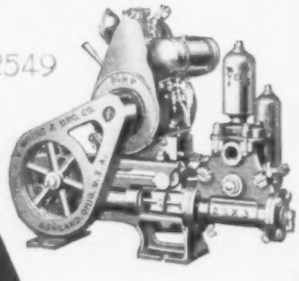


FIG. 2510

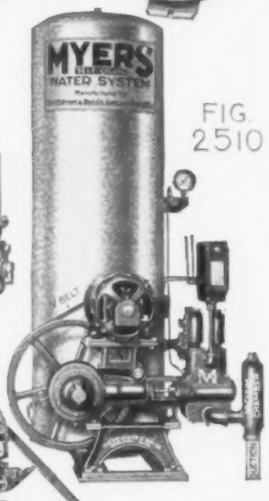
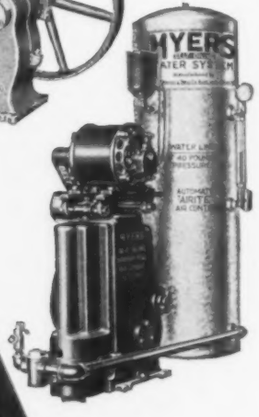


FIG. 2527



FIG. 2511

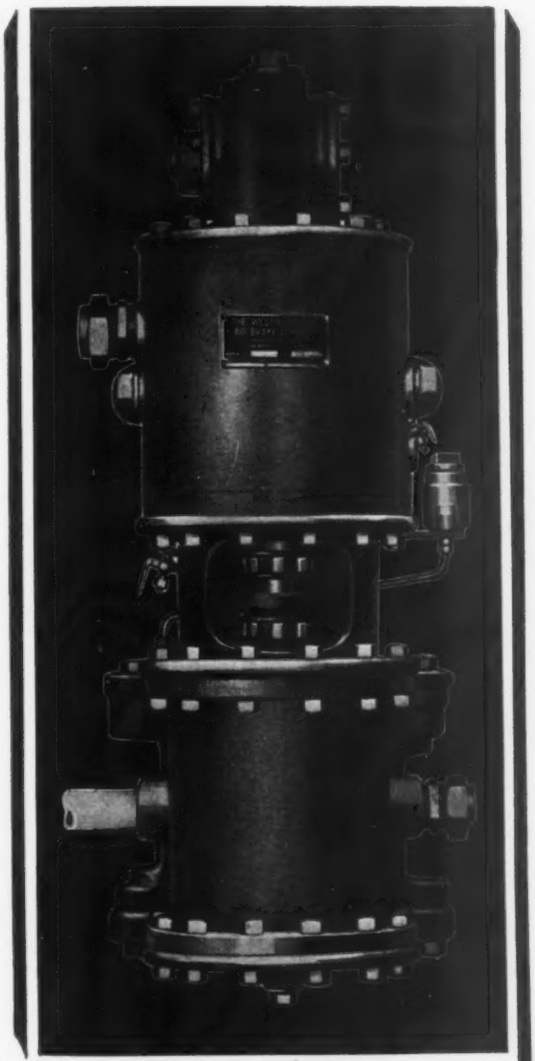


THE F. E. MYERS & BRO. CO.
ASHLAND, OHIO.

Take Off Your Hat To The MYERS
PUMPS · WATER SYSTEMS · HAY TOOLS · DOOR HANGERS

PUMPS ✧ WATER SYSTEMS ✧ HAY TOOLS ✧ DOOR HANGERS

DEPENDABLE
Steam-Driven Air Compressors
For Industrial Service



WESTINGHOUSE Steam Driven Air Compressors—the same as used on locomotives for air brake service—are admirably suited for a wide range of industrial uses.

They are available in several sizes: the single stage type, 35, 49, and 66 cu. ft. displacement; the two stage type (steam and air compounded) 120 and 150 cu. ft. displacement.

These machines, being self-contained and compact, occupy minimum floor space, and are easily installed by fastening to a strong column, hoisting engine boiler, or on a stand made for the purpose.

Where steam supply is available these compressors are ideal. They are simple in operation, reliable, and have an enviable record for durability and low maintenance expense.

WESTINGHOUSE TRACTION BRAKE CO.
General Office and Works ▼ Wilmerding, Pa.

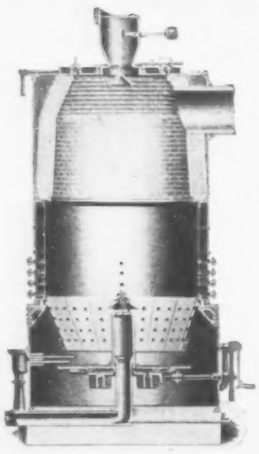
We also build a complete line of motor driven air compressors ranging in sizes from 3 to 700 cu. ft. displacement, in a great variety of types to suit any industrial need.

WESTINGHOUSE-NATIONAL
Air Compressors
"Quality Machines for Quality Service"

WOOD *mechanical* GAS PRODUCERS

FORTY YEARS OF PROGRESS

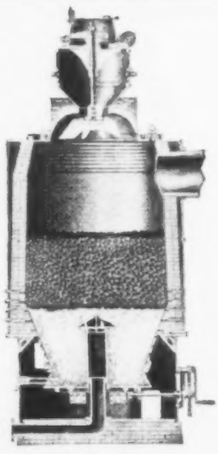
1889 to 1929



1889

The above cut shows the first type of mechanical (revolving ash table) gas producer ever built and introduced by us forty years ago.

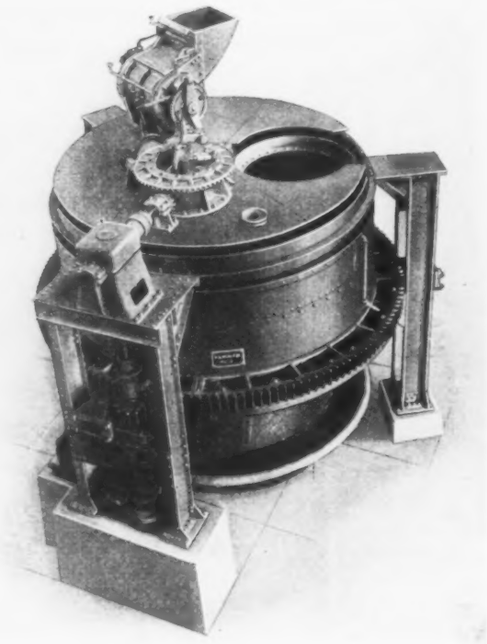
The cut below shows the first *full* mechanical gas producer built by us. It was noted for its superior gasifying capacity.



1898

We were also pioneers in equipping gas producers with mechanical coal feeders. The above cut shows our revolving ash table producer with this early type of feeder.

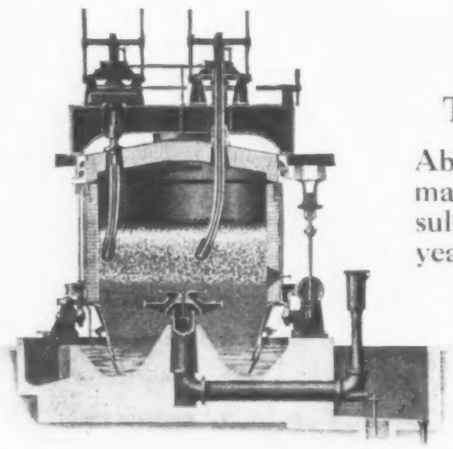
A later, improved design of our full mechanical gas producer is shown in cut below. We were first to equip gas producers with turbo-fan blowers.



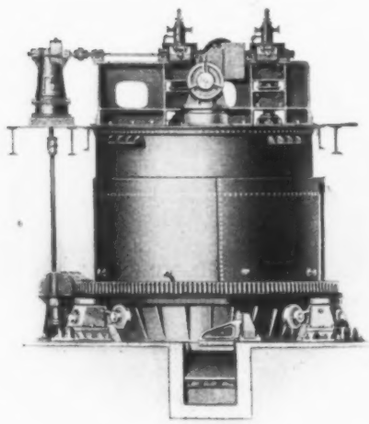
1929

TYPE SB

Above—Our *latest* machine. The result of our forty years of progress.



1912



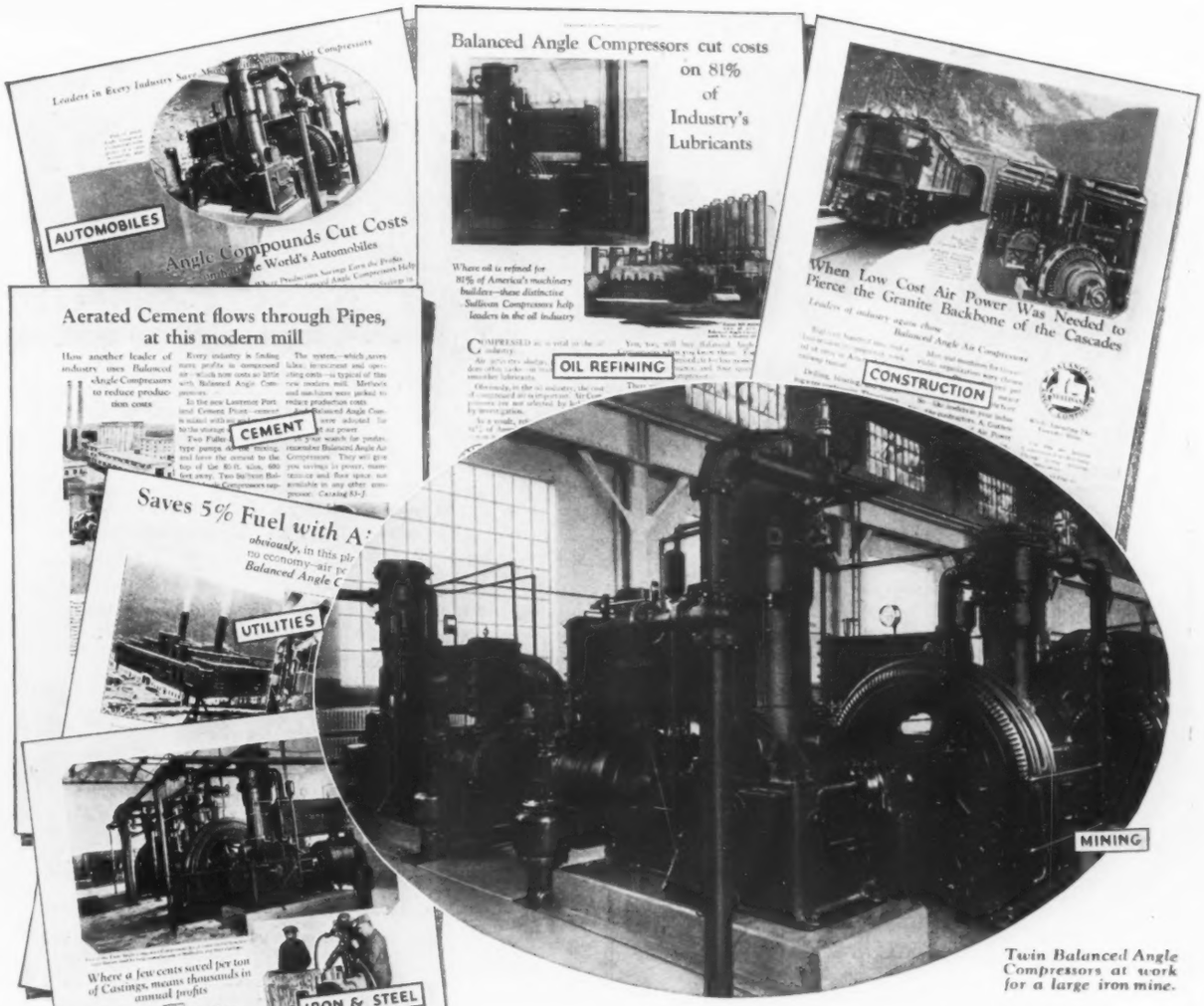
1922

R. D. WOOD & CO.

PHILADELPHIA, PENNA.

Established 1803

FOUNDRIES AND WORKS: FLORENCE, N. J.



Twin Balanced Angle Compressors at work for a large iron mine.

Send for portfolio of advertisements showing Balanced Angle Compressors, in plants of industry's leaders.

Big Business Adopts Balanced Angle Compressors

Big business is setting a new pace. Facts—not opinions—are guiding its methods and selection of machines.

And big business has adopted air power by Balanced Angle Compressors.

Builders of half the world's automobiles—

Makers of two-thirds of America's electrical equipment—

Refiners of eighty percent of industry's lubricants—

Great foundries, power plants, lumber mills, mines—

—now save money with Balanced Angle Air Compressors.

For these distinctive machines have proved their ability to supply air for less power, and lower maintenance.

The facts that persuaded big business to use Sullivan Compressors are available for you.

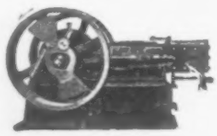
Send for Booklet 83-J.

SULLIVAN MACHINERY COMPANY

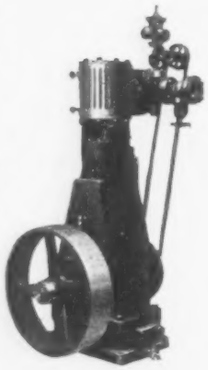
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Offices in all principal cities in the world

STEAM ENGINES



The simplicity of design in a Troy Engine makes it a very efficient and dependable unit for continual operation. For instance, this throttling, self-oiling engine is thoroughly reliable for driving stoker shafts. A simple chronometer valve eliminates troublesome switches, rheostats and gear shifts. The self compensating, balanced, flat valve is positive assurance of high steam economy.



The complete Troy Line is illustrated in our catalog, a copy of which will be sent you for the asking.

Troy Engine & Machine Co.

Troy, Penna. 118 W. Ohio St., Chicago, Ill.

Distributors for Canada

Riley Engineering & Supply Co., Ltd.
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VALVES · AND · FITTINGS

78 years of Service to Industry

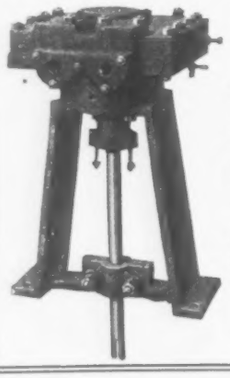
As the passing of 1929 marks another milestone in the long history of the Jarecki organization; as "77 years of service" becomes "*78* years of service"—may we not take this occasion to express our wishes for 78 years of progress and prosperity for you?

Jarecki

MANUFACTURING COMPANY

ERIE, PA., U. S. A.

Vertical Frame Air Motors



for Agitators, Mixers, Submerged Pumps, or

Other installations where vertical shaft is required. Furnished in non-reversing type with either right hand or left hand rotation. Also reversing type. Sizes 2 H.P. to 30 H.P.

DAKE Air Motors Have No Dead Centers

They start, stop and reverse instantly. Require no expert attendance and give lasting satisfactory service. Catalog on request.

DAKE ENGINE COMPANY
Grand Haven, Mich., U. S. A.

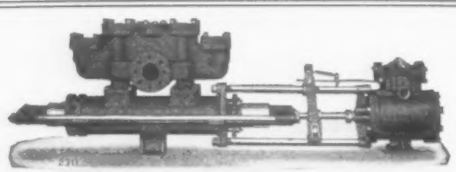
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Hydrants and Fittings

Gate, globe, check and angle valve patterns for handling steam, water, air, gas, oil and chemicals. Bronze, bronze-mounted iron-body, iron and steel valves.
Fire Hydrants and Underwriter valve equipment.
Cast iron, malleable iron and brass pipe fittings.
Send for Catalog.

THE KENNEDY VALVE MFG. CO. ELMIRA, N.Y.

New York, Chicago, San Francisco, Philadelphia, Cleveland, Atlanta, El Paso, Seattle, Salt Lake City, Los Angeles



HEAVY DUTY PRESSURE PUMPS
RUGGED—RELIABLE—ECONOMICAL

ESTABLISHED 1869

DEAN BROS. COMPANY

MANUFACTURERS OF PUMPING MACHINERY FOR ALL PURPOSES

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INDIANAPOLIS IND.



HIGH PRESSURE VALVES and FITTINGS. Hydraulic Machinery.

ANKER ENGINEERING CO.
Widener Bldg. Philadelphia

BURY

AIR AND GAS COMPRESSORS
VACUUM PUMPS

ALL SIZES, ALL TYPES, ALL PRESSURES
TO MEET ANY ENGINEERING REQUIREMENTS

BURY COMPRESSOR CO., 1706 Cascade St. ERIE, PA.



DART for Durability



Dart Unions give years of satisfactory service. They cannot leak, rust or corrode and can be used over and over again when changes in pipe line are made.

Free samples on request.

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Canadian Factory: Dart Union Limited, Toronto

E. M. Dart Mfg. Co.
Providence R. I.

Century Wood Preserving Co.

SERVICE

All forest products treated with all standard preservatives by all standard processes

Address Inquiries to Nearest Office

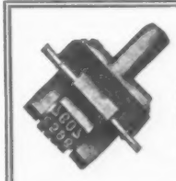
Boston—New England Wood Preserving Co., Chamber of Commerce Bldg.
New York City—Delaware Wood Preserving Co., 30 Church Street.
Philadelphia—Delaware Wood Preserving Co., Finance Bldg.
Pittsburgh—The Ohio Wood Preserving Co.; Pittsburgh Wood Preserving Co., Koppers Bldg.
Reed City—Michigan Wood Preserving Co., Reed City, Michigan.

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for every conceivable purpose—

Washers, Gaskets, Wicks, Pads, Strips, for lubricating, dustproofing, insulating, etc.

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734 Sherman St. CHICAGO, ILL.

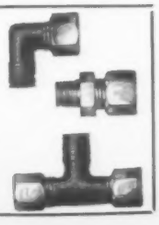


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Automatic Numbering Heads will prove economical

for serial numbering on parts made of steel, brass, wood, fibre, etc., such as name plates, metal tags, machine parts, etc. Made to order in any style or size of figures. Write for particulars.

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Hartford, Connecticut, U. S. A.

Brass Pipe and Tube Fittings



Stock Patterns are Specially Designed for Connecting Brass and Copper Tubing

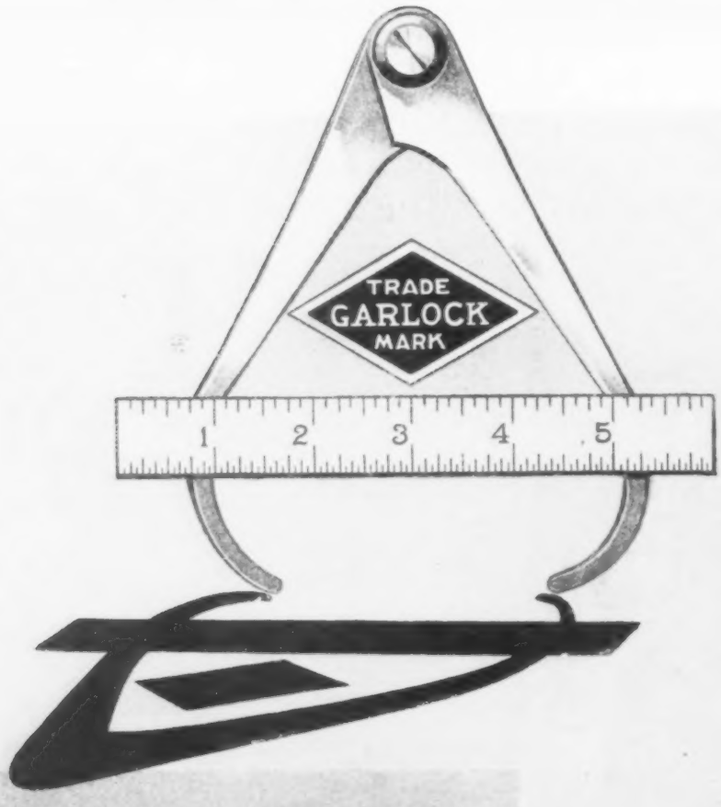
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Quotations on Specials on Receipt of Print or Sketch.

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THE GARLOCK PACKING COMPANY

Palmyra, New York

Sales Offices and Warehouses in All Principal Industrial Centers



How many men do you HAVE to see when you buy insulation?

. . . . ONLY ONE!

WHEN you are busy and the important problem of purchasing insulation comes before you it saves time to talk to one man who is prepared to discuss intelligently *every* form of insulation to meet every need.

When a J-M sales engineer calls on you he is fully prepared and thoroughly equipped to assist you in any problem which may confront you on insulation. He represents an organization which for seventy years has been the leading authority on industrial insulations. He can offer you insulation in any form and combination whether it be block, brick, plaster or filler to meet your insulation needs and to cover every temperature range from the lowest to the highest. He has no particular type of insulation to push in preference to any other. His one idea is to give you an insulation job that will prove the most satisfactory and that will save the most money for you.

The J-M representative has available for your use facts, figures and vitally important data that seldom get into print. He brings to your particular problems an engineering experience and understanding that should be helpful to you. And if your insulation needs are special or unusual his assistance in putting your problems clearly before our engineering department is well worth the time you give him.

JM PRODUCTS

Johns-Manville

INDUSTRIAL INSULATIONS

For all temperatures from 400° F. below zero to the highest industrial temperatures

JOHNS-MANVILLE CORPORATION
New York, Chicago, Cleveland, San Francisco, Toronto
(Branches in all large cities)

Please have a J-M representative call to discuss Insulation in our plant.

Name _____

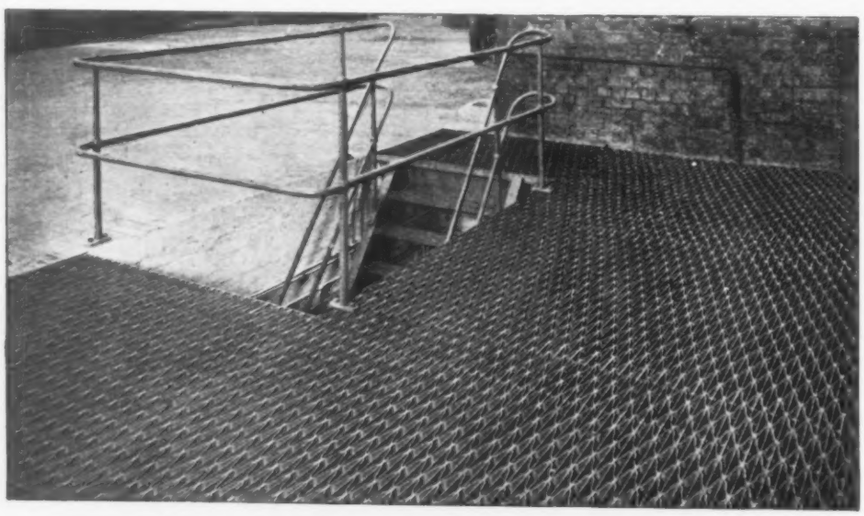
I-21-1

Address _____

CONTIN in every

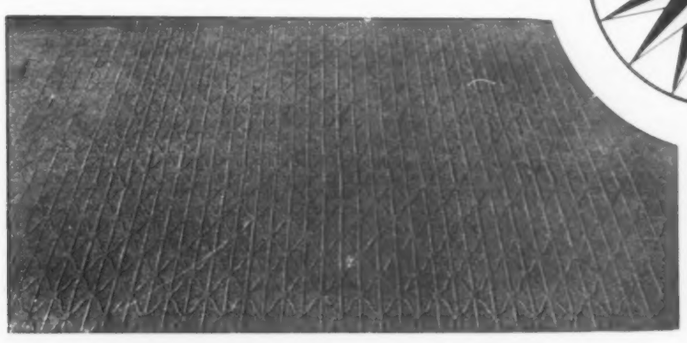
Whether you're considering an open steel floor, or a floor of armored concrete, remember this:—no flooring or armoring made up of separate panels, or of an assembly of loose bars, can even approach the permanent, outstanding advantages of a **continuous** steel structure.

In **Irving Continuous Steel Flooring** the hazards of careless butt joints between loose panels—the unsightly joint lines—the traffic obstructions—are totally eliminated by the **streamline** splice. You have an unbroken, unified, rigid, **continuous** trussed steel structure over any area you need. And it costs no more than make-shift substitutes. See Bulletin 2H7.



IRVING STEEL FLOORING

UOUS direction!



For the armored floor of concrete or other material, **Irving Continuous Floor Armoring** will make it shock-proof, wear-proof, crack-proof, with a surface reinforcement of an unbroken, rigid, unified, **continuous** steel mesh structure that takes the traffic loads from the weaker floor material. And here again you pay no more for conspicuous superiorities. Read Bulletin 2K7.

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Long Island City, N. Y., U. S. A.

British Licensees
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South Molton Road, Victoria Docks
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Crowe's Iron Works, Ltd.
Guelph, Ontario, Canada

IRVING FLOOR ARMORING

Here is a "Safety" Feature.....You Must Not Overlook

in your "Safety Improvement" plans for 1930. The surface around every piece of dangerous machinery; surfaces which are subject to oil, water, grinding compounds, etc.; dangerous walk-ways and long flights of stairs should all be covered with

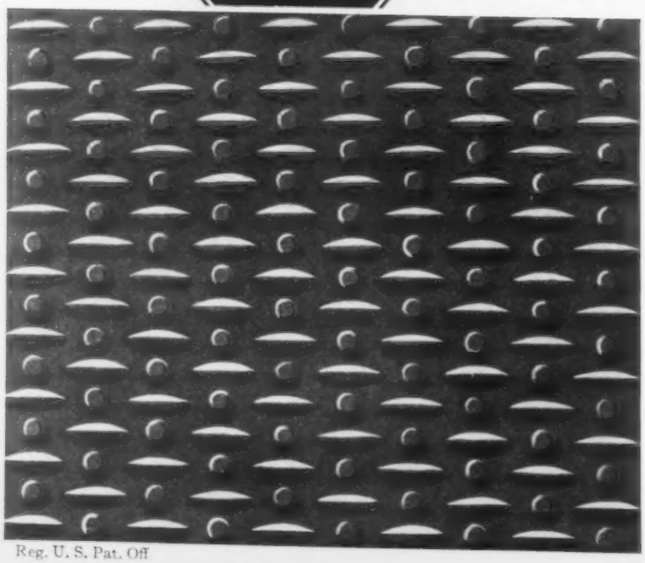
CENTRAL "KNOBBY" NON-SKID FLOOR PLATES

It is the most efficient floor plate on the market for the prevention of slipping feet. In fact, its gripping qualities are so unique and positive that it has been granted patent rights. It is the only floor plate manufactured today that has been able to secure a patent.

Would you like a sample of this plate and further information?—Write or wire

CENTRAL IRON & STEEL CO.,
HARRISBURG, PA.
Branch Offices in All Principal Cities

ALSO MANUFACTURERS OF
Steel Plates (Sheared and Universal Mill), Boiler and Tank Heads (Flanged and Dished), Blue Annealed Steel Sheets, Wrought Steel Plate Washers, Special Steel Stampings.



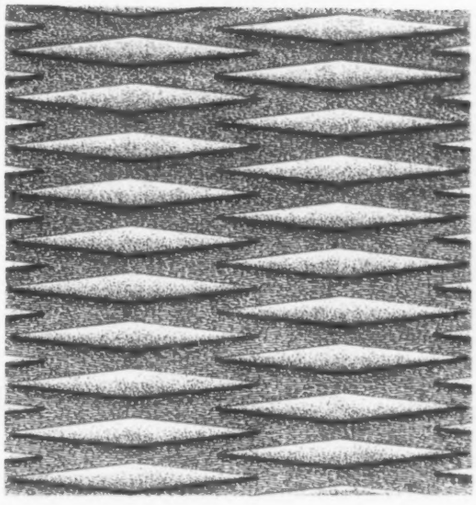
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Tread with safety on the safety tread plate

For Safety and Long Life—

Specify NEVERSLIP floor plates



The Plates with the "PERFECT DIAMOND" Pattern

You can't go wrong, if you "specify" NEVERSLIP FLOOR PLATES—because they're Rolled from highest grade Open Hearth Steel, to give a NON-SLIPPING, LONG WEARING SURFACE, affording maximum safety to man, beast or vehicle.

NEVERSLIP FLOOR PLATES "are different" from other plates, not alone due to their distinctive PERFECT DIAMOND PATTERN—but because of their design and method of manufacture.

NEVERSLIP FLOOR PLATES are available in the PERFECT DIAMOND PATTERN or the straight corrugated RIBBED PATTERN. They can be effectively and economically used for a multitude of purposes—such as: Flooring, Walkways, Stair Treads, Runways, Platforms, Fire Escapes, Cellar Doors, Thresholds, Trench Covers, Bridge Traffic Plates—or, in short, wherever a LIGHT, NON-SLIPPING, STRUCTURALLY STRONG SURFACE IS REQUIRED.

P. S.—Be sure of the plate with the "Perfect Diamonds"

AMERICAN PRESSED STEEL CO.

Commercial Trust Building—Philadelphia—Penn.

(Representatives in Principal Cities)

American Pressed Steel Co.—Commercial Trust Bldg.—Philadelphia, Pa.

Please send me your Literature and a Sample of NEVERSLIP Floor Plates for the following uses:

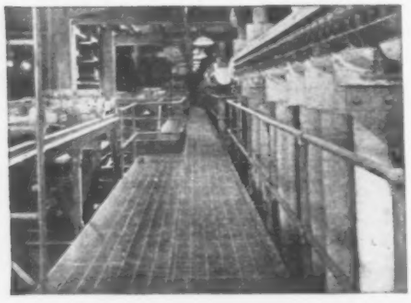
.....

Mr.....Title .....

Firm .....Address.....

I.A. 1/2/30

MITCO PRODUCTS



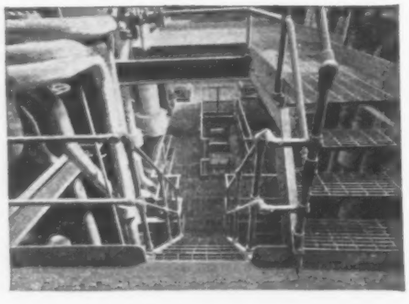
MITCO *Interlocked Steel* GRATING

Wherever open flooring is required, Mitco Interlocked Steel Grating is ideal. It is made of square-edge steel bars, high in tensile strength, which are formed (under hundreds of tons' hydraulic pressure) into panels of great strength and rigidity. No bolts, rivets or welding are employed. Furthermore, Mitco has rectangular openings which comprise 90% of the area of the Grating, thus assuring maximum light and ventilation. In addition, Mitco is non-slipping and non-clogging. It is furnished in types and depths to suit every requirement. Write for bulletin.



MITCO ARMORGRIDS

Where floors, platforms, ramps and driveways (made of cement, concrete or other plastic materials) are subject to wear, shocks and abuse, Mitco Armorgrids provide shock-proof reinforcement. They are quickly and easily installed, requiring no fitting, fastening or assembly. They are merely laid on the rough base of the structure, with the finishing grout of flooring material poured into the mesh. The result is a steel mesh that absorbs destructive actions, preventing development of crack-outs and wear, thus prolonging the life of the structure. Write for bulletin.



MITCO SHUR-SITE TREADS

On stairs, ladders and fire escapes, Mitco Shur-Site Treads give the walker confidence and minimize the possibilities of falls caused by overstepping. They have a deep nosing bar bent back at an angle under the front edge which makes the Tread stand out clearly at all times. This nosing bar is self-clearing, having no pocket to collect snow, dirt or refuse. Mitco Treads are furnished in lengths and widths to meet every need. They come with carrier plates attached, ready for application. Write for bulletin.

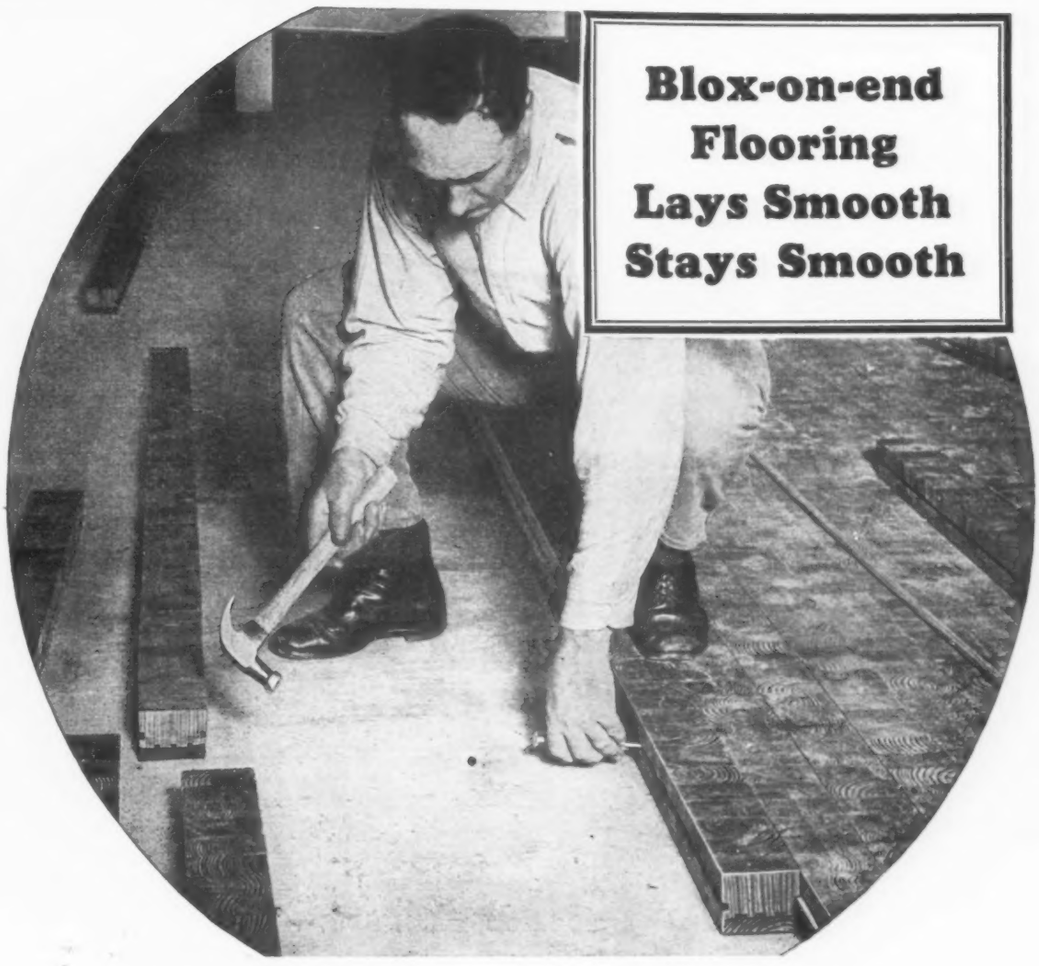
HENDRICK MANUFACTURING CO.

42 Dundaff Street, Carbondale, Pa.

New York Office: 15 John St. 'Phone Cortlandt 2440
Pittsburgh Office: Union Trust Bldg.
Chicago Office: Railway Exchange Bldg. 'Phone Wabash 5768

Baltimore, Md. Birmingham, Ala. Boston, Mass. Cleveland, Ohio Detroit, Mich. Erie, Pa. Hazleton, Pa. Indianapolis, Ind. Montreal, Can. Philadelphia, Pa. San Francisco, Calif. Seattle, Wash. Tulsa, Ok'a.

Makers of Hendrick Perforated Metal Screens, Elevator Buckets of All Types, Steel Plate Construction, and Hendrick Heating and Ventilating Grilles.



Blox-on-end Flooring Lays Smooth Stays Smooth

End grain *durability* combined with matched floor *smoothness* . . . that's BLOXONEND. No loose blocks, tar or pitch. The 8 foot built-up flooring strips are laid with splines and nailed (nails come already positioned in countersunk bores). The result is a clean, odorless, resilient factory floor that is long-lived and durably smooth. Laid directly over old or new concrete or wood floors.

The durability of BLOXONEND eliminates floor upkeep. Its lasting smoothness speeds up trucking and does away with vibration damage to trucking equipment and product. Easily laid in old plants without interrupting operations. Write for our Booklet "Factory Floors." It contains installation and performance data and lists hundreds of prominent concerns who have found it profitable to pay a higher first cost for BLOXONEND.

CARTER BLOXONEND FLOORING COMPANY

KANSAS CITY, MISSOURI

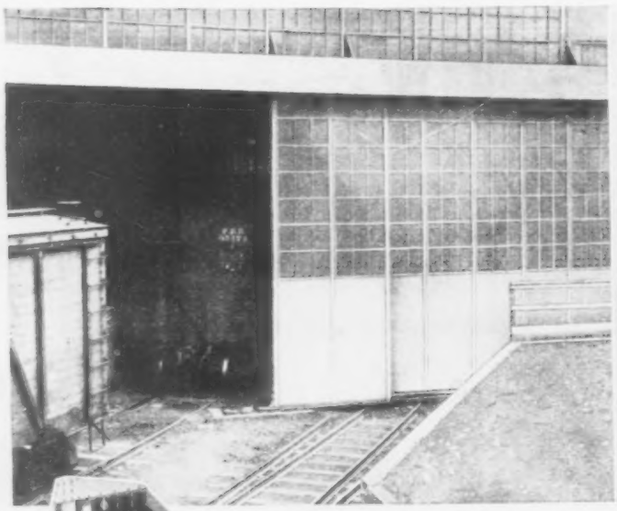
Representatives in leading cities

BLOX-ON-END FLOORING

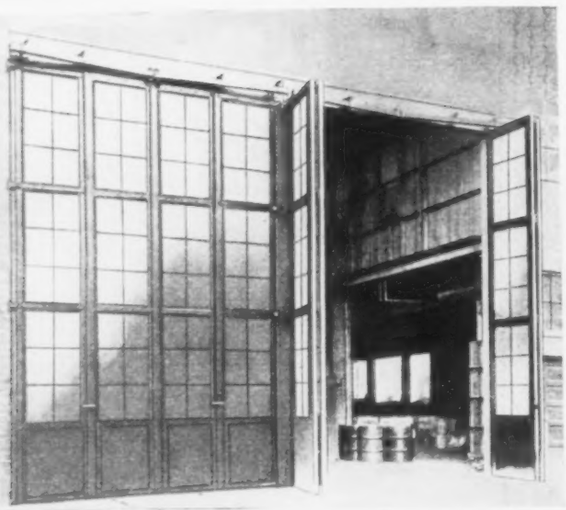


Bloxonend is made of Southern Pine with the tough end grain up. It comes in 8 ft. lengths with the blocks dovetailed endwise onto baseboards

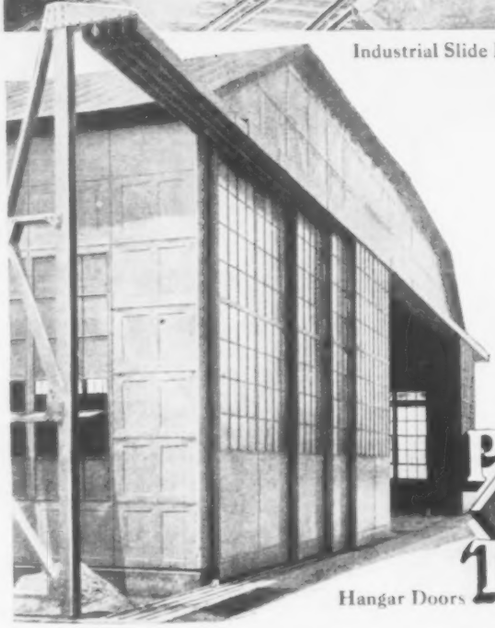
Lays Smooth
Stays Smooth



Industrial Slide Doors



Vertical Folding Doors



Hangar Doors



Standard Doors

A PRODUCT OF TRUSCON

STEEL DOORS

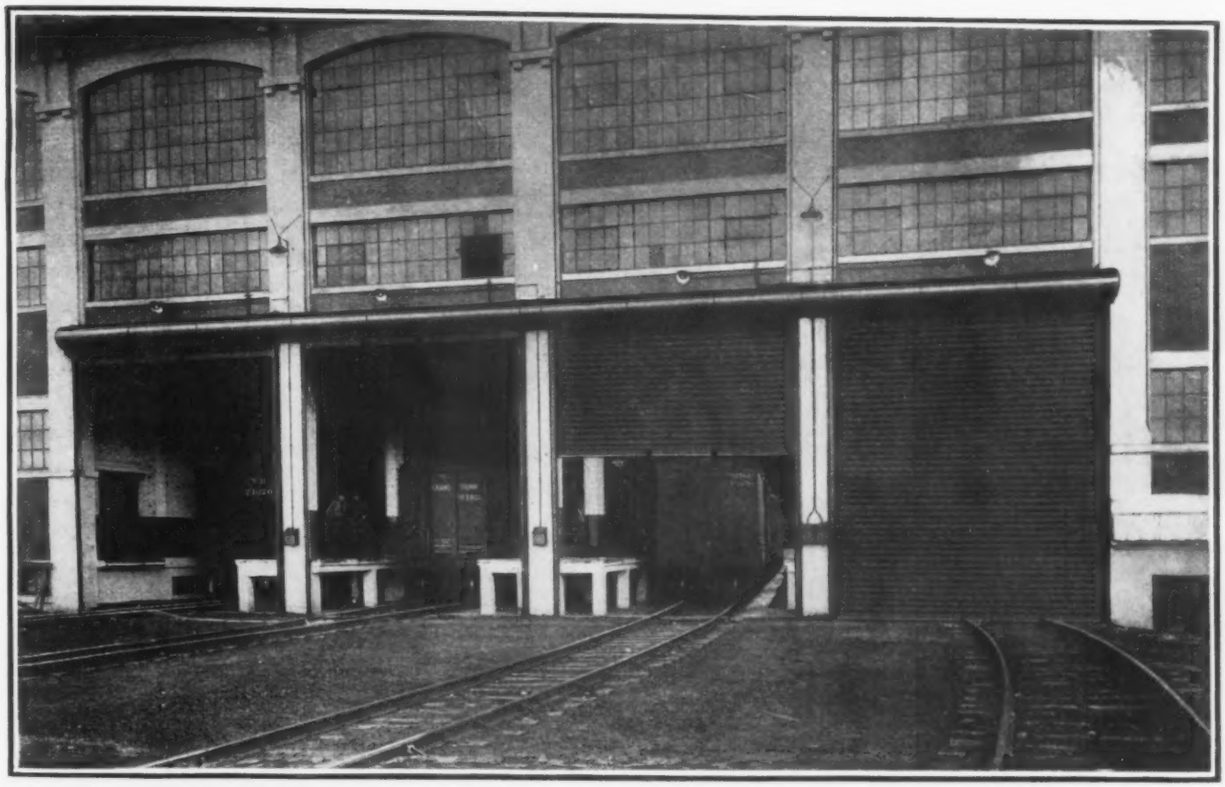
Quality of workmanship, durability of construction, ease of operation and permanence of service are features which distinguish Truscon Steel Doors. They provide thorough protection for industrial buildings, garages, hangars, service entrances, etc. They are furnished in either standard stock types or in special designs to meet the individual requirements of each installation. Truscon engineers will gladly cooperate in the development of efficient doors for any building. Write for Door catalog.

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

STEEL DOOR DIVISION

Truscon Steel Company of Canada, Limited, Walkerville, Ontario

Warehouses and Offices in Principal Cities



they do cost a trifle more—but— they're well worth the difference!

Experienced architects, contractors, engineers and building owners who plan and build for permanence know that the slight additional cost of Kinnear Rolling Doors is more than fully justified by their performance. That's why specifications almost invariably read "Kinnear Rolling Doors—**or equal.**" They are recognized universally as the standard equipment of their type. And, no wonder! Kinnear is the original rolling door. Every improvement in rolling door design and construction has been pioneered by Kinnear. Measured by any basis of comparison except first cost, Kinnears are by far the cheapest. From a standpoint of weight, durability, maintenance, ease and smoothness of operation—all around satisfaction—truly, indeed, "There **IS** No Equal." Don't allow lower first cost to blind you to the ultimate economy of Kinnear Rolling Doors.

Every Kinnear Rolling Door is "Engineered". There are no stock patterns.

KINNEAR ROLLING DOORS

There IS No Equal

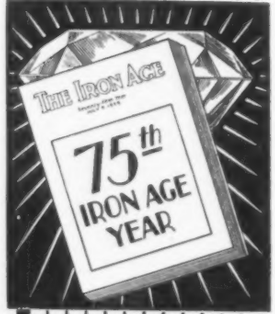
New catalog showing modern uses for Kinnear Doors free on request.

THE KINNEAR MANUFACTURING CO.

817-867 Field Avenue, Columbus, Ohio, U. S. A.

BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT WASHINGTON
NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH KANSAS CITY

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extends heartiest
New Year's greetings
and Best Wishes
to its readers
and to its advertisers.
As we pass the
three-quarter century
mark we are just getting
our second wind
and
feeling seventy-five
years young,
are ready
to work harder than ever
for you
in the year 1930
and during the next
seventy-five.



Kellogg safeguards industrial power *from uncertain operation or failure*

THROUGH progressiveness, industrial America is firmly established in the position of leadership among the producing countries of the world. This rapid growth of American industry is largely due to the use of power, and the wisdom of industrial leaders in adopting new principles in power generation and equipment.

In keeping with this progress, the Kellogg development of forge and hammer lap welded boiler drums is an outstanding achievement. Leading power companies were quick to appreciate the safety and ultimate economy of these boiler drums, and each year a larger number of industrial plants are following power company practice.

The Kellogg principle of construction provides a boiler drum entirely free from cold working strains, and not subject to caustic attack. Elements contributing to fatigue failures have been eliminated through this type of construction, and every Kellogg boiler drum goes into service with a strength which assures safety and unfailing performance.

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ALL KELLOGG FORGE AND HAMMER LAP WELDED PRODUCTS ARE INSURABLE

ILLINOIS FLOOR PLATE



Section M-41

Furnished to the following dimensions:

Thickness—3/16" to 3/4" exclusive of raised figure.
Weight—8.8 to 31.7 pounds per square foot.
Width—6" to 72".
Length—240" maximum for all gauges and widths.

This design drains and cleans readily and is recommended for all service where a safe footing is required.

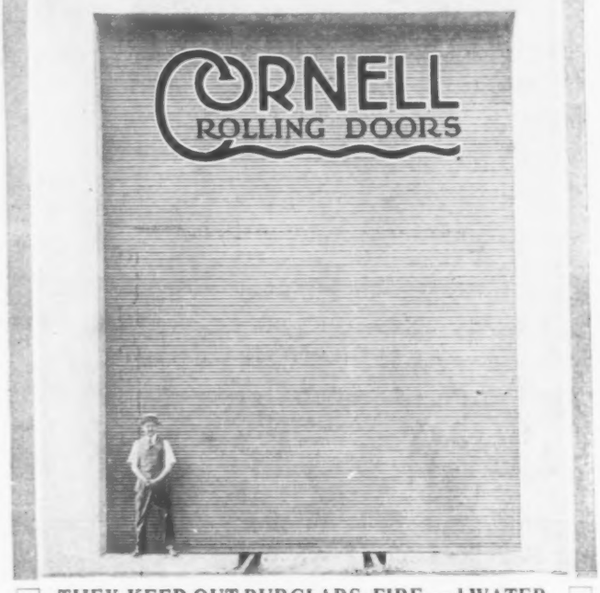
Illinois Steel Company

Subsidiary of UNITED STATES STEEL CORPORATION

General Offices: 208 South La Salle Street, Chicago, Illinois

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CORNELL ROLLING DOORS



THEY KEEP OUT BURGLARS, FIRE and WATER

No matter what the type of building—garages, warehouses, piers, public buildings, store fronts—Cornell Rolling Doors give absolute protection against burglary, water and fire. Built of a series of steel interlocking cold rolled slats, they are stiff against pressure, but flexible to roll.

When not in use they are rolled up out of the way overhead. They operate easily and simply, even in the largest sizes. Consult our Engineering Department, or write for Catalog No. 40.

CORNELL IRON WORKS

Established 1846

Long Island City New York

HOGGSON BRAND
HAND CUT STEEL STAMPS
FORMERLY "YALE BRAND"



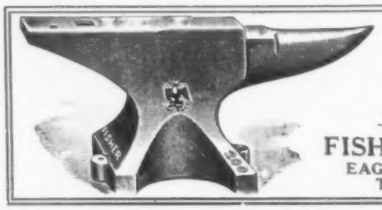
The life of a stamp depends on the correct shaping and proper tempering.

Try the

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for stamps or Marking Dies of all kinds.

The Hoggson & Pettis Mfg. Co.
New Haven, Conn., U. S. A.



"EAGLE" ANVIL

First Guaranteed Anvil Made in U. S. A. —Standard for 86 Years

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EAGLE ANVIL WORKS
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There's More Money in Crushed Turnings

The American Chip Crusher will reduce yours so economically and bring about such savings in oil, labor, space and shipping costs, that it will pay for itself in a few months. Write us for full particulars.



AMERICAN CRUSHER AND MACHINERY CORP.
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For 100% Efficiency, Install

VITEK Automatic Adjustable STEEL STOOLS



Equip your offices, mills, factories, and drafting rooms with these up-to-date stools and seating equipment. May be adjusted to any height in one second! Simply lift up on the seat and it locks in place!

Comfortable back rest and adjustable foot rest optional. 3 and 4 legged models. 20 styles to choose from. Swivel attachment at small extra cost.

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SCIENTIFIC MANAGEMENT is the foundation upon which every progressive business enterprise must be built in order to enjoy prosperity in the highest degree.

Many business lines could be saved by adopting only a few simple corrective measures.

Facts and details are available.

STONE, FRANCIS & HART

Industrial Engineers and Accountants

165 Broadway New York, N. Y.



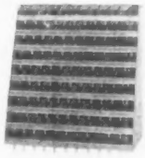
No. 1218 Bench Drawer: All-steel, sturdy. Complete with guides, screws and bolts. Furnished with or without lock, or with padlock hasp and staple. Three sizes to choose from.



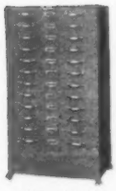
NO. 1018 CHAIR



No. 48-30 BENCH



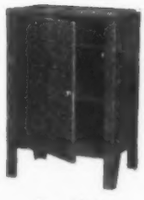
No. 108 DRILL BIN



No. 12-24 CABINET



No. 38 STEEL DESK



No. 36-24 TOOL CABINET



No. 24-20 LATHE CHIP PAN

ENGINEERED FOR GREATEST PRODUCTIVITY



YOU will find ANGLE STEEL Equipment of proper design, sound construction and adaptability to innumerable jobs about your plant. This equipment is carefully planned to increase production, lower operating and labor costs and give long-lived trouble-free service.

No. 44 Stool. All-steel with 16 gauge sheet steel seat. 13″ in diameter. Back rest, 6″ x 12″, riveted to adjustable steel pillars. Angle steel legs, strongly braced. Ball-turned feet. Seven seat heights from 14″ to 28″. Finished in olive green enamel.

No. 218 D.C. Machine Tender. An all-purpose truck, extremely well-built and durable. Rolls on 2″ swivel casters, 1″ wide. Made of 1½″ angle steel and 16 gauge black sheet steel, rigidly braced. Hand-riveted joints; Drawer is lock-equipped for tool, parts and die storage. Truck size: 24″ x 18″ x 35″ high. Edges of shelves may be turned up or down. Finished in olive green enamel.

Catalog "C-IA" illustrates and describes over 250 items, as: Benches, Bench Legs, Bins (Drill & Reamer), Cabinets, Chairs, Desks, Tables, etc.

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Angle Steel Equipment

OT. STEEL

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ANGLE STEEL STOOL CO., Plainwell, Mich.

☐ Send Representatives
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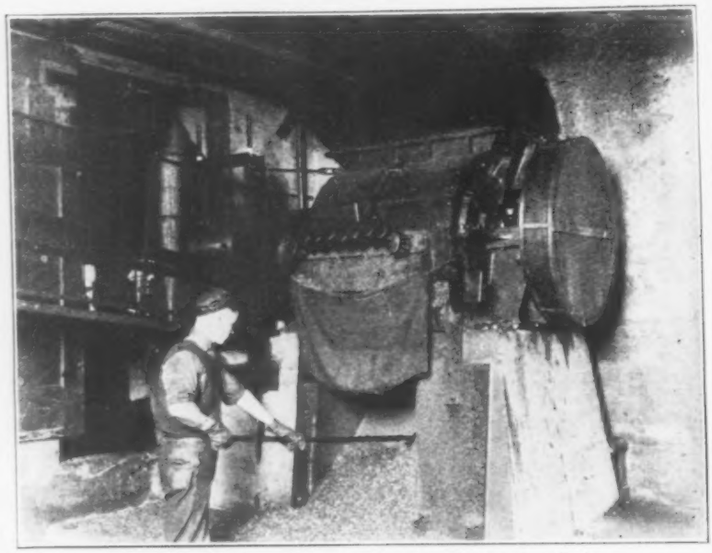
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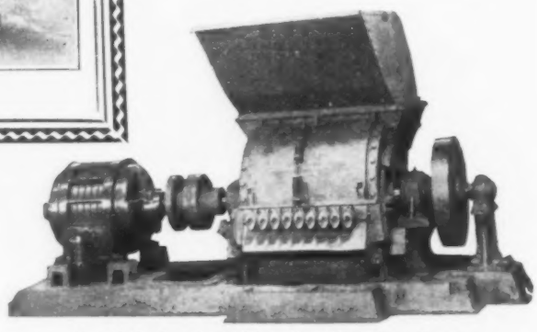
WOULD $5,415.80 INTEREST YOU?

CERTAINLY IT WOULD



No. 3800 American Ring Steel Turnings Crusher Installation

AUTOMOTIVE MANUFACTURERS and other concerns producing large tonnages of turnings have submitted figures showing their savings. These are available for your use at all times.



No. 3800 American Ring Steel Turnings Crusher
(Patented)

IT would interest anybody. And that's the exact amount one company saved in a year by operating an American Ring Steel Turnings Crusher. This was a typical case where a better price for crushed turnings of shovel size, and lower handling and chipping costs netted a substantial profit.

Just a few tons of turnings per week in your own shop will put an American Ring Crusher on a paying basis.

American Ring Steel Turnings Crushers are built for heavy service. Built of steel castings, and manganese crushing parts, high production is possible at a low operating cost.

Get the detailed facts—based on impartial surveys.

AMERICAN RING STEEL TURNING CRUSHERS ARE NOW THOROUGHLY "TIME TESTED"

"Time will tell." That is what manufacturers say about chip crushers. But they never say that today.

Repeat orders from firms like General Electric Co., Buick Motor Co., Chevrolet Motor Co., Oakland Motor Co., and others, tell the story. Manufacturers who have bought American Ring Steel Turning Crushers are now enjoying the profits they visualized at the start.

Originators of the Rolling Ring Crusher Principle

THE AMERICAN ROLLING RING COAL CRUSHER FOR COAL, COKE AND LIGNITE

To obtain good economy, coal should be of uniform size. Leading Central Stations and Industrial Power Plants are using the "AMERICAN RING" Crusher for preparing their run-of-mine or lump coal to sizes required for unit pulverizers or automatic stokers. Coal sizing is becoming of greater importance day by day. The American RING Coal Crusher needs no formal introduction. Installations of these crushers have become so numerous that it has come to be looked upon as the standard of quality in modern Power Plants, where efficiency, economy and low maintenance cost are standard requirements. These coal crushers are sold on a definite guaranteed performance basis. Break-downs are not known to American Ring Crushers. They are built to pass tramp metal without injury. The flexibility of the Rolling Ring System protects the machine from foreign material.

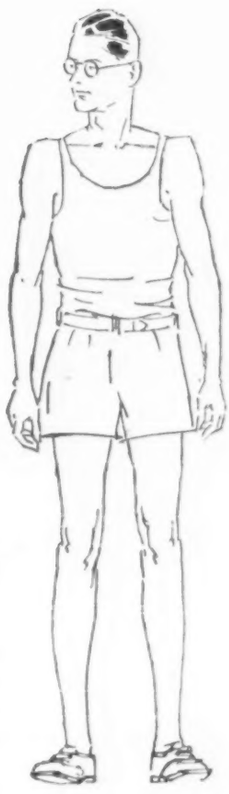
Write for complete details and list of installations in your vicinity.

American Pulverizer Co.

1249 Macklind Ave., St. Louis, Missouri



He couldn't stand the gaff in a flimsy track suit



IF YOU were coach of a football squad you wouldn't shoot your star halfback into the fray garbed in a flimsy track suit. You'd fit him with togs built to defy the rough and scuff of gridiron service.

Foundry and mill work is no pink tea occupation. Molders, welders and mill workers daily face the liability of leg injuries. Are your workmen *fully* protected against leg accidents? . . . Safeguarded against heat, flame, flying sparks and splashes of metal? . . Protected against nasty blows?

Burlap "leg wrappers" are unsafe. Cheap leggings are costly at any price.

Now, you can give your workmen a degree of leg protection never before possible. You can take a definite step toward reducing leg accidents. The new "Safety Service" Legging is entirely new in design. Embodies features of safety never before found in a legging. Unites rugged strength with new-found comfort to the wearer. Offers a degree of value that deserves the serious consideration of every executive responsible for plant safety and plant profits.

Take note of the 7 outstanding features of construction listed below . . . then order a sample pair of the new "Safety Service" Legging for trial in your plant.

THE SAFETY EQUIPMENT SERVICE CO.
BUELL W. NUTT, *President*
Manufacturers of a Complete Line of Accident Prevention Equipment
1228 ST. CLAIR AVENUE · CLEVELAND OHIO

7 Distinctive Features

that deserve careful study

1 Wide-range adjustability. Fits any size or contour of leg. One style of legging for all legs. Eliminates necessity of carrying different styles and sizes.

2 Double-stitched for double strength. Adds strength—increases "wear-and-tear" resistance.

3 Reinforced with two pieces of fibre, specially molded to fit contour of leg. Adds strength—gives extra protection—insures snug, comfortable fit.

4 Tempered steel stay slips easily into notch. "On with ease—off in a jiffy." Two layers of heavy leather provide positive insulation against heat transmission.

5 Reinforced at flare seam with steel stitching. Rip-proof.

6 Specially tempered steel spring shapes the flare to contour of instep. A smooth, unbroken surface.

7 Extra layer of leather reinforces bottom of flare. No crumpling, bunching or sagging at arch or instep.



The greatest value on the market at . . . **$ 3.00 the pair**
$36.00 the dozen pair

SAFETY
PREVENTION
ACCIDENT EQUIPMENT
SERVICE

Fill in and mail TODAY, please.

THE SAFETY EQUIPMENT SERVICE COMPANY
1228 St. Clair Avenue · Cleveland, Ohio

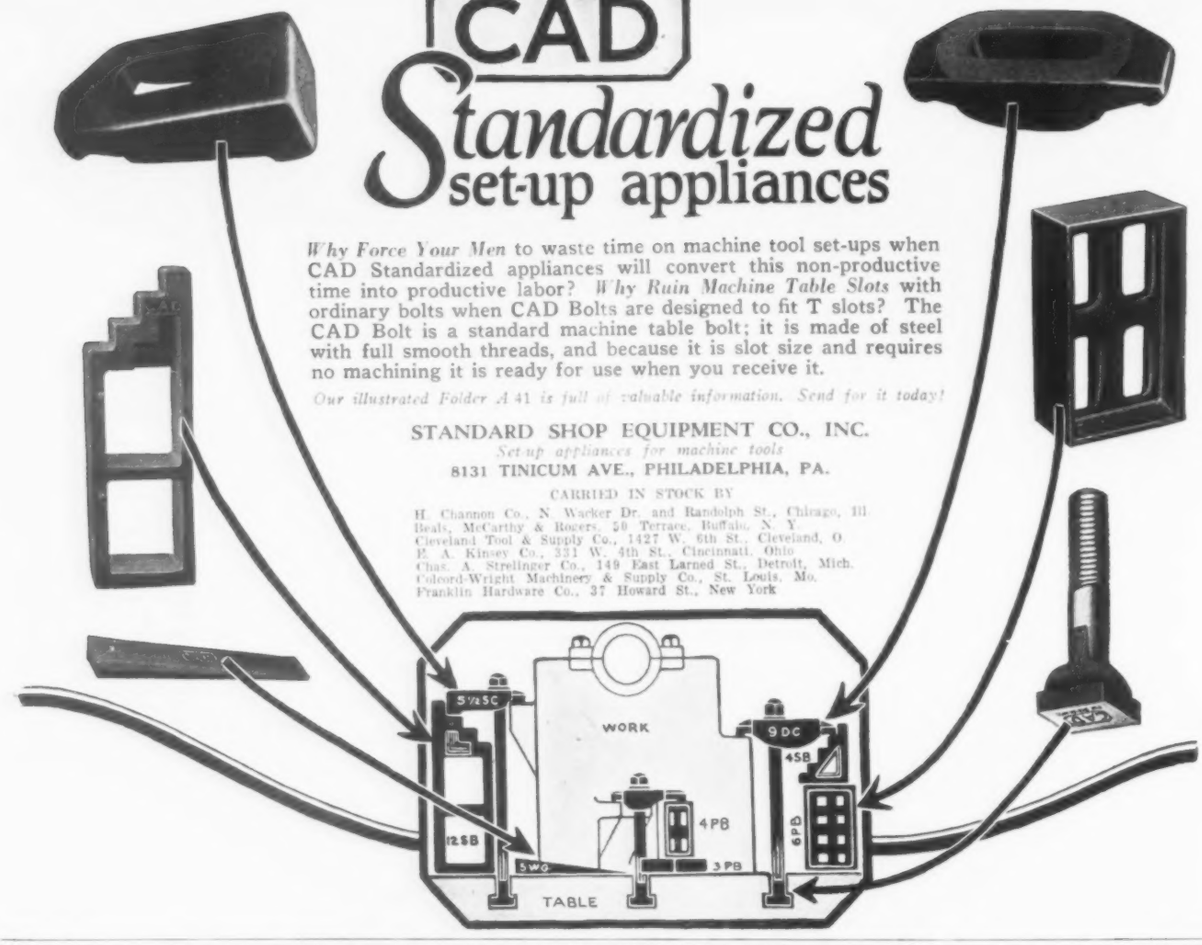
- ☐ Send sample pair of new "Safety Service" leggings.
- ☐ Send folder illustrating different styles of leggings.
- ☐ Send copy of general catalog.

Your Name _____

Company _____

City _____ *State* _____

CAD Standardized set-up appliances



Why Force Your Men to waste time on machine tool set-ups when CAD Standardized appliances will convert this non-productive time into productive labor? *Why Ruin Machine Table Slots* with ordinary bolts when CAD Bolts are designed to fit T slots? The CAD Bolt is a standard machine table bolt; it is made of steel with full smooth threads, and because it is slot size and requires no machining it is ready for use when you receive it.

Our illustrated Folder A 41 is full of valuable information. Send for it today!

STANDARD SHOP EQUIPMENT CO., INC.
Set-up appliances for machine tools
8131 TINICUM AVE., PHILADELPHIA, PA.

CARRIED IN STOCK BY
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Beals, McCarthy & Rogers, 50 Terrace, Buffalo, N. Y.
Cleveland Tool & Supply Co., 1427 W. 6th St., Cleveland, O.
E. A. Kinsey Co., 321 W. 4th St., Cincinnati, Ohio
Chas. A. Strelinger Co., 149 East Larned St., Detroit, Mich.
Colcord-Wright Machinery & Supply Co., St. Louis, Mo.
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SPACE	NUMBER OF INSERTIONS					
	1	2	4	8	26	52
1"	$5 75	$5 25	$4 75	$4 38	$4 13	$4 00
2"	10 50	9 50	8 75	8 25	8 00	7 75
3"	15 75	14 25	13 13	12 38	12 00	11 63
4"	19 00	17 50	16 50	16 00	15 50	15 00
5"	23 75	21 88	20 63	20 00	19 38	18 75
6"	28 50	26 25	24 75	24 00	23 25	22 50
8"	35 00	33 00	32 00	32 00	30 00	29 00
⅓ page	46 67	44 00	42 67	42 67	40 00	38 67
12"	52 50	49 50	48 00	46 50	45 00	42 00
½ page	66 00	64 00	64 00	62 00	58 00	54 00
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The Clearing House is used by those who want to sell odd lots of material, idle equipment, surplus machines.

We want to Buy is used to locate emergency supplies, equipment, machinery where low cost is essential.

Contract Work annually places thousands of dollars worth of business ranging from one small experimental casting, to complete assemblies totaling millions of pieces.

Business Opportunities sells plants, businesses, offers partnerships, invites capital, places capital—through the whole range of metal trades activities.

Help Wanted is self explanatory—but offers a higher class of technical positions, and a higher class of technical help than the usual medium.

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profit by using

THE CLASSIFIED SECTIONS

of The Iron Age

The Clearing House

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(ORIGINATED BY US)

GRINDERS

These other fine machines too.....

must be precision machines. Without precision, they defeat their own purpose. Our experience and special factory process of restoration insure precision for these grinders. They have been Re-Manufactured with special attention to their accuracy. And you'll be surprised at the savings.

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1—48"x50' Pond.
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1—45"x24' Pond.
1—42"x17' American Gd. Hd.
1—42"x34' American Gd. Hd.
1—42"x26' American Gd. Hd.
1—36"x71' American Gd. Hd.
1—36"x42' Gisholt Gun Borer.
1—36"x34' American Gd. Hd.
1—36"x26' American Gd. Hd.
1—36"x14' Johnson.
1—30"-34½"x12' L. & S. Sel. Gd. Hd.
1—30"-34"x12' L. & S.
1—30"x11' H. S. & G.
3—26"x18' Bridgeford.
3—26"x16' N.-B.-P.
3—26"x16' Whit.-Blaisdell.
10—26"x16' Bridgeford.
3—26"x14' Bridgeford.
5—26"x14' N.-B.-P.
3—26"x13' Wickes.
3—26"x12' Putnam.
5—26"x12' Bridgeford.
13—26"x11' Wickes.
40—26"x10' N.-B.-P.
15—26"x10' Canada.
15—26"x10' Whit.-Blaisdell.
14—26"x10' Bridgeford.
11—26"x9' Bridgeford.
4—26"x8' Bridgeford.
1—26" LeBlond Crank Shaf. Lathe.
9—25"x12' LeBlond.
1—24"x10' Cisco.
5—20x22"x12' American.
2—20-22"x8' American, M.D.
30—20-22"x8' American.
1—18"x12' LeBlond G.H.
1—18"x9' Chard.
1—16"x12' Sundstrand Mfg.
1—16"x10' Sundstrand Mfg.
3—16"x8' American Gd. Hd.
1—16"x8' Hendey.
1—14"x12' LeBlond Gd. Hd.
1—14"x10' Pratt & Whitney.
1—14"x6' LeBlond.
2—14"x6' Lodge & Shipley.
2—14"x6' Flather.
5—3½"x60" Fitchburg Loswing.
1—3½"x108' Loswing.

Vertical Milling Machines

1—No. 1 Becker.
1—No. 2 Brown & Sharpe.
1—No. 2 Cincinnati.
1—No. 5 Becker.
1—No. 5-B Becker.
1—No. 5 Brown & Sharpe.
6—No. 6 Becker.
1—Model CS Becker.
2—Model SD Becker.
1—Model ACS Becker.

Planers

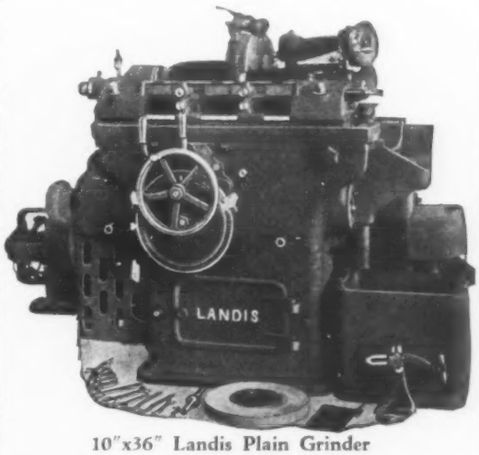
1—72x84"x12' Gray.
1—60x48"x12' N.-B.-P.
1—56"x56"x32' Cincinnati.
1—56"x56"x16' Cincinnati.
1—48"x48"x16' N.-B.-P.
1—48x48"x10' Gray.
1—48x48x10' N.-B.-P.
3—36x36"x18' Cincinnati.
1—36x36"x16' Ohio.
1—36x36"x16' N.-B.-P.
1—36x26"x10' Whitcomb-Blaisdell.
2—36x36"x8' Ohio.
1—36x32"x8' Cincinnati.
1—30x30"x14' Niles-Bemen-Pond.
1—26x26"x10' Gray.
2—24x24"x6' Gray.
1—24x24"x6' Flather.
2—24x24"x6' Woodward-Powell.
1—24x24"x6' American.

Vertical Boring Mills

1—14'-20' Niles Extension.
1—10' Niles.
1—96" Betts.
1—72" Niles.
1—72" Bickford.
1—72" Pond.
1—61" Baush.
1—60" Pittsburgh.
1—42" Colburn.
1—36" Bullard Rapid Prod.
2—36" Gisholt.
2—32" King.
1—30" Flather.
1—30" Gisholt.

Slab Milling Machines

1—24x13"x20' Ingersoll.
3—24x24"x12' Ingersoll.
1—36x30"x7' Newton.
1—45x17½" Ingersoll.
1—50"x20' Ingersoll.
1—No. 3 92x54"x15' Beaman & Smith, Milling and Boring Machine Planer Type.
1—Beaman & Smith open side.
1—3 spdl. Beaman & Smith.



10"x36" Landis Plain Grinder

OUR GUARANTEE

Your money back if you return a machine within thirty days, freight prepaid. No excuses necessary.

1—51" Bullard.
1—52" Gisholt.
1—51" Baush.
1—51" Bullard
1—48" Colburn.
2—42" Gisholt.
3—42" King.

Milling Machines

1—No. 5 Cincinnati.
1—No. 5-B Becker-Brainard.
1—No. 4 Cincinnati.
3—No. 3 Cincinnati.
3—No. 3 Brown & Sharpe.
1—No. 2-B Milwaukee.
1—No. 21 Brown & Sharpe.
2—No. 2-Y Brown & Sharpe.
1—No. 1-B Milwaukee.
1—No. 1 Brown & Sharpe.
2—No. 20 Oesterlein.
1—No. 1½ Rockford.
7—No. 25 Becker.
1—No. 3-H LeBlond Univ.
1—No. 2-B Milwaukee Univ.
1—No. 2-M Cincinnati Univ.
1—No. 1 Kempsmith Univ.
3—Type B Briggs.
1—12" Cincinnati B. G. Mfg.
3—18" Cincinnati Auto.
1—48" Cincinnati Auto.
1—Putnam, Semi-Auto.
3—No. 33 Kempsmith Mfg.
175—P. & W. Hendey, Becker and Garvin Lincoln Millers.

GRINDERS

1—26"-37½"x96" Norton Gap.
1—18x96" Norton.
1—16x52" Landis.
2—16x50" Norton.
1—16x48" Landis Crank Pin Grinder.
1—14x72" Norton.
1—14x50" Norton.
5—14x36" Norton.
1—12x36" Modern.
2—10x72" Norton.
2—10x72" Landis.
3—10x52" Landis.
6—10x50" Norton.
1—No. 40 Bryant Wide Wheel External.
2—10x36" Norton.
5—10x36" Landis.
2—10x24" Landis.
4—10x24" Norton.
3—No. 12 8x36" B. & S.
10—6x32" Norton.
1—5x18" Ott Plain Grinder.
1—No. 10 6x20" B. & S.
1—No. 60 Heald.
11—No. 70 Heald.
1—No. 10-A Bryant Internal.
2—No. 20 Bryant Internal.
1—No. 1 Modern Univ.
2—No. 1 Landis Univ.
1—No. 2 Bath Universal.
1—10" x 36" Thompson Universal Cutter Grinder.
1—18" Graham Surf.
1—14" x 36" Pratt & Whitney Surf.

Drill Presses

1—2-spindle H. & W.
1—6-spindle H. & W.
1—No. 2 4-spindle Foote-Burt.
1—No. 4 6-spindle Foo e-Burt.
1—No. 4 4-spindle Foote-Burt.
1—No. 17 2 or 4-spindle Foote-Burt.
2—No. D-31 Fox Mult.
1—No. 12-C Fox Mult.
1—No. 12 Nateo Mult.
1—No. 14 Fox Mult.
1—No. 2 Western Mult.
1—No. 3 Western Mult.
1—21" Weigle.
1—22" Barnes, Self-Oiling.
2—24" Foote-Bur.

Horizontal Boring Machines

1—No. 1 Cleveland.
1—5" Bar Ingersoll.
1—2-spindle Espen-Lucas Boring, Milling and Drilling Machine.
1—Beaman & Smith Cylinder Boring and Milling Machine.
1—No. 3 Barnes Hor. Radial.
4—No. 1 Barrett.
2—No. 2 Rockford.
1—7"x60" Springfield Spindle Borer.

Turret Lathes

2—26" Libby.
26—24" Davis.
8—24" Steinle.
5—24" Gisholt.
3—21" Gisholt.
1—18" Libby.
1—No. 3 Cincinnati Acme.
1—No. 3-A Warner & Swasey.
2—No. 2-A Warner & Swasey.
1—No. 6 W. & S.
1—21x8" LeBlond.
2—No. 6 Brown & Sharpe.
3—3x36" Jones & Lamson.
3—2-spdl. Jones & Lamson.
1—18" W. & S.
1—16" Cincinnati-Acme-Fox.
1—14" Warner & Swasey.

Auto Screw Machines

3—No. 52 National Acme.
1—1¾" 6-spdl. New Britain.
1—No. 33 New Britain.
1—No. 2-P Potter & Johnston.
4—No. 5-A Potter & Johnston.
6—No. 6-A Potter & Johnston.

Gear Cutters and Hobbers

1—No. 5 60" Brown & Sharpe.
3—No. 36-H Gould & Eberhardt.
1—36"x12" G. & E.
4—No. 12 Barber-Colman.
1—No. 3 26" Brown & Sharpe.
4—No. 6 Fellows.
1—No. 61 Fellows.
1—12"x24" G. & E.
1—12"x10" G. & E.
1—No. 3 Barber-Colman.
1—No. 1 Schuchardt & Schutte.

Hand Screw Machines

1—No. 10 3" Bardons & Oliver.
3—No. 6 3⅛" Warner & Swasey.
1—No. 10 Foster.
1—No. 7 Foster.
1—No. 6 2¼" Warner & Swasey.
1—1⅛" D. & W.
1—No. 1 Foster.

Shapers

1—16" Barker.
1—16" Columbia.

Presses

1—No. 54 Bliss.
1—No. 4 Walsh O. B. I.
1—No. 4½ R. & K.
1—No. 10 Zeh & Hahnemann.
1—No. 73½ Bliss.
1—No. 57 Toledo Nosing Press continuous stroke.
5—No. 58 Toledo Nosing Press continuous stroke.
1—No. 59 Toledo Doub. Grd.

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1—2½" Gang.

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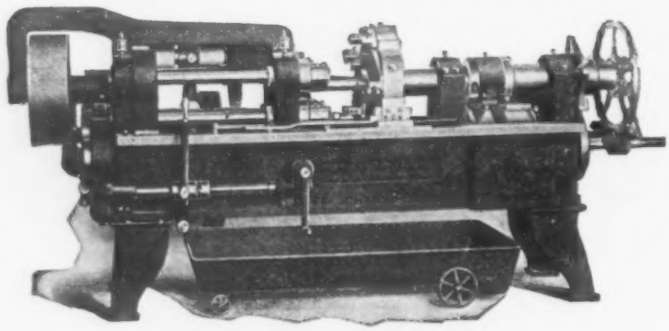
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12—Precision Bench Lathes.
1—Monarch 28x10' Q.C.G.
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1—Natco 18-in. Motor Driven Heavy Duty.
1—Henry & Wright Class B 12-in. overhang 3 spdle. Drill Press.
3—Leland-Gifford 12-in. Sgle. Spdle.
1—Colburn D4 24-in. Sgle. Spdle. Heavy Duty.
3—Avey No. 2 Ball Bearing Sens.
3—Pratt & Whitney No. 13 Multiple Spdle.

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10—Bliss Nos. 1, 2, 3 and 4 "Stiles" Type.
5—V&O No. 2½ Inclinable Power Presses.
2—Zeh & Hahnemann No. 5 Inclinable Presses.
15—Farrel Presses (Various Sizes).
1—15 on Power Forcing Press Lucas (motor dr.).
1—Waterbury-Farrel No. 6 Geared Double Action Pillar Cam Press.
150—Bench Foot Presses.

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1—Betts 16-in. Stroke Crank Slotter.
1—Standard No. 3 300 lb. Auto. Belt Drop Ham.
1—Manville No. 1 Double Stroke Open Die Motor Driven Header.
1—Gorton No. 1D Motor Dr. Engraving Machine
1—2-Ton Shepard Electric Crane 60-ft. Span.
1—Whitcomb 24x24x6 Planer, Second Belt Drive.
1—Whitcomb 30x30x12 Planer, Second Belt Dr.
2—New Haven 36"x46" Model "A" Self Contained Sand Blast Barrels.

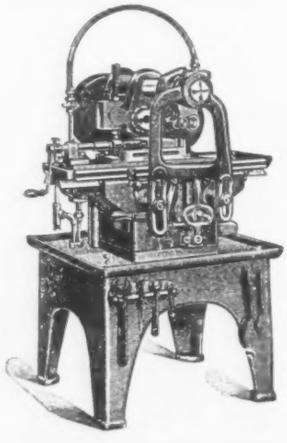
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4—Brown & Sharpe No. 2 Surface.
2—Heim Centerless Grinders (Motor Drive).

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2—Barber-Colman No. 2 Gear Hobbers.
1—Gleason 11-in. Bevel Gear Generator.
1—Gleason 18-in. Bevel Gear Generator.
1—Gleason 24-in. Bevel Gear Planer.
6—H. Pfauter Gear Hobbers.
4—Brown & Sharpe No. 3—26-in. Automatic.

SHAPERS

2—Potter & Johnson 15-in. Univ. Crank Shapers.
1—Milwaukee 16-in. Crank Shaper.
1—Gould & Eberhardt 16-in. B.G. Crank Shaper.
1—Hendey 20-in. B.G. Crank Shaper.
3—Gould & Eberhardt 14-in. High Duty Crank.
3—American 15-in. Universal Crank Shapers.

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2—Kempsmith No. 33 Lincoln Type Production.
16—Pratt & Whitney 4½-in.x12-in. Thread.
20—Brown & Sharpe and Hendey Universal.
20—Pratt & Whitney, 5-in. Automatic.
1—Cincinnati No. 2 Plain.
75—Lincoln Type Millers.
12—Brown & Sharpe No. 12 Plain.

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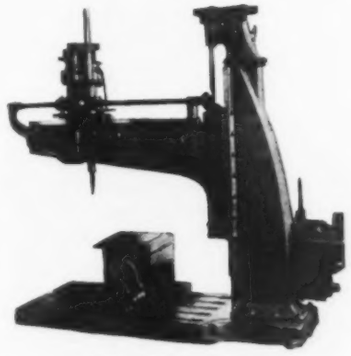
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All back geared—power feed adjustable tables
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3—4′′ spindle Henry & Wright.....$475
2—4′′ Prentice plain bearing.....$125
1—3′′ Leland Gifford
6—2′′ Henry & Wright Class "B".....ea. $300
7953—6 spindle National Acme horizontal....$325
2—5 spindle Detroit.....$350

MULTIPLE DRILL PRESSES

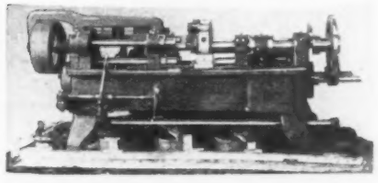
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No. 12 Pratt & Whitney, arr. 12, equip. 10..$775
No. 12 Nateo tapping, arr. 8, equip. 8.....$1075
No. 11 Nateo, arr. 16, equip. 10.....$675
Gardam, arr. 12, equip. 10.....$475
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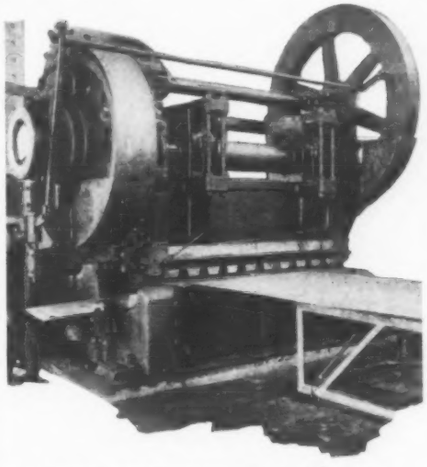
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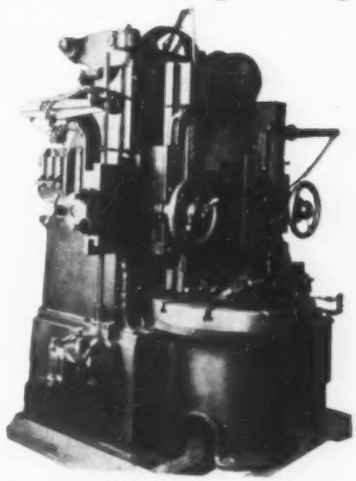
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16′′ Stockbridge.....$475
16′′ Hendey friction.....$325
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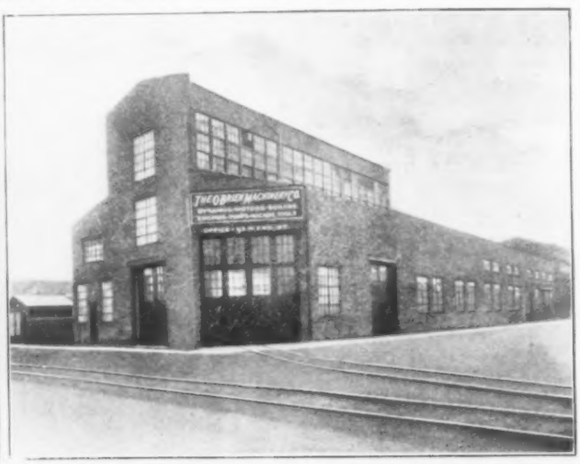
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1½"x18" Pratt & Whitney.
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No. 24 New Britain 1¾" Gridley Model F.
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No. 2 High Power Cincinnati, Gd. Hd.
PIPE MACH., 8" Saunders; 6" Oster.
BOLT CUTTER, 2½" Acme, Double Head.
UPSETTER, 1½" Ajax, Stop Motion, Steel.
BRAKES, 8'x3/16" Robinson; 6'x10 Ga. D. & K.
SHEARS, 8'x3/16" & 52"x16 Gauge Niagaras.
RADIAL DRILLS, 6' American, Univ. Gear Box.
4' Dreses & 3½' Bickford, Gear Box.
3½' Mueller, Cone; 3' Western, M/D.
WHEEL PRESS, 200 Ton Putnam, Hydraulic.

New 3 phase motors 1 to 15 H. P.
5 H. P., $65.50

Boring Mill, No. 3 Colburn, Vertical.
Compressors, 6x5, 6x6, 8x8.
Drill, Baush, 5' radial.
Drill, Hilbert, 3' radial.
Drill, No. 66 D Moline Hole Hog, 7 spindle.
Drills, 24", 26", 28" & 32" sliding head.
Furnace, Weco elec. oven.
Gear Cutter, No. 13 Brown & Sharpe.
Grinders, Surface No. 1 and No. 78 W. & M.
Grinder, 6"x15" Fitchburg, plain.
Grinder, 12"x36" Cincinnati Universal.
Grinder, 16"x18" Landis Universal.
Lathe, 13"x6' Willard quick change.
Lathe, 14"x6' Monarch, quick change.
Lathe, 15"x6' Sebastian, motor drive.
Lathe, 20"x10' Hailton, new model.
Lathe, 20"x10' American geared head.
Lathe, 21"x24' Prentice.
Milling Machines, 24"x20"x8' Ingersoll horizontal.
Milling Machines, No. 2 Bilton (2).
Milling Machine B. & S. No. 2 heavy.
Miller, Becker No. 7.
Miller, No. 2 Kempsmith plain, new.
Planer, 24"x24"x6' American, 1 head.
Planer, 36"x36"x12', Gray, extra heavy, 4 heads.
Planer, 36"x36"x11' Gray, two heads.
Planer, 42"x42"x12' Gray, two heads.
Presses, Federal open back inclinable.
Presses, Nos. 1, 1½, 2 and 4 Robinson.
Punch and Shear, 3½"x½", 10" throat.
Screw Machine, Defiance No. 4.
Screw Machine, Milholland, 1" and 1½".
Shaper 16" American Back Geared Crank.
Shaper 16" O. & S., new.
Shaper, 24" O. & S., cone drive.
Shear, No. 362 Robinson square.
Shear, square 60" Pexto, 18 gauge.
Shear, No. 20 Quickwork, 14 gauge, 30" throat.
Shear, No. 12 Pettingell, 60" throat.
Washing Machine, Blakeslee.

THE OSBORNE & SEXTON MACHINERY COMPANY
COLUMBUS OHIO

TURRET LATHES

Two 24" Swing
One 28" Swing
One 30" Swing

Rebuilt and Guaranteed in A-1 Condition

Steinle Turret Machine Co.
Madison, Wis.



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Don't Limp Along with Inadequate Equipment in 1930

MANY machine users "get along" with inadequate machinery because they don't care to invest a lot of money in new equipment. On the other hand, a greater number have learned that it isn't necessary to spend a large sum for the equipment they need. They have proved to their own satisfaction that *good* used machinery is very much worthwhile.

Morey *Rebuilt* Machinery has converted many "unbelievers." Morey Machinery can put *your* business in a position where it is fully capable of competing with the many competitors in your field who are at present better equipped than yourself. If you don't see the machinery you need in the following list, write to us.

Up-To-Date Machinery and Equipment Made By The Best Known Manufacturers

BORING MILLS

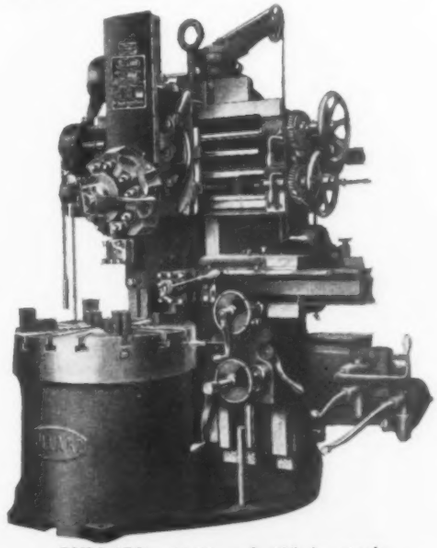
3—BULLARD 24", 36", 42" N. E.
1—BULLARD 36" R. P. side head
2—GISHOLT 52", 60"; 2 hds.
1—BETTS 6', cone dr.
1—BETTS 10' DC, MD.
1—SELLERS 72" ver., 2 heads.
1—POND 10-24' ver.
1—NBP 10-16' ver., 2 heads.
1—BETTS 12' ver., 2 heads.
1—NILES 14' vertical.
1—NILES 16-24' Extension Ver.
1—BARRETT No. 3 Horiz.
1—LANDIS No. 35 horiz.
1—BEMENT 50" duplex horiz.
1—N.B.P. 4½" bar Duplex Contr.
1—ROCKFORD No. 2 Horiz.

DRILLS—Multiple Spindle

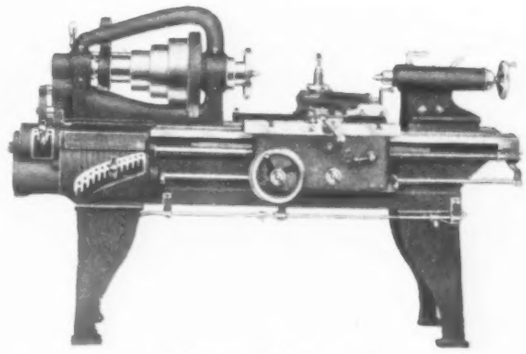
1—BAUSH Nos. 1, 2.
2—FOX D-31.
1—MOLINE No. 5-D Cyl. Borer.
3—NATCO Nos. 11, 12.

DRILLS—Upright

2—BARNES 20" and 24" Camel.
5—DETROIT 5-spindle.
1—FOOTE BURT 4-spindle.
7—HENRY & WRIGHT 2, 4, 6. spindle.



BULLARD—24-36 and 42" in stock



Hendey 14-16-18" in stock

2—P. & W. No. 2 Gun.
1—NEW TURNER No. 3 Ver.

DRILLS—Radial

1—AMERICAN 3' MD.
1—BAUSH 6'.
2—DRESES 4', 6' Pl.
1—AMERICAN 6' triple pur.
1—N.B.P. 96" Plain.

GEAR CUTTERS

7—B. & S. 3x26, 3x36, 4x36.
3—B. & S. No. 6, 60" cap.
1—B. & S. No. 13.
6—CINCINNATI 16" Hobbers.
6—BARBER COLMAN No. 12.
2—GOULD & EBERHARDT No. 36-H, 18-H.
3—FELLOWS Gear Grinders.
6—FELLOWS Nos. 6, 61, 65, 615.
3—GLEASON 6", 11", 18".

GRINDERS

9—LANDIS 6x18, 10x24, 10x36, 12x36, 12x96 Pl.
6—NORTON 3x18, 6x32, 10x24, 10x36, 16x50, 16x36, 10x72.
1—NORTON 20x144" Gap MD.
1—NORTON 24x144" Gap MD.
1—NORTON 16x50 Crank.
2—LANDIS 10x52 Cam.
1—BLANCHARD No. 16 Surf.
2—DIAMOND Nos. 2 and 3 Surf.
12—HEALD Nos. 65, 60, 70, 75, 80.
1—BATH Spline.
1—GIDDINGS & LEWIS No. 12 Teromatic.
1—P. & W. 22x7 Surf.

HAMMERS

1—NEW BRADLEY 20-lb. Helve.
1—CHAMBERSBURG 400 Bd. Dr.
1—BILLINGS & SPENCER 800-lb. Drop.
1—TOLEDO 1500-lb. Bd. Drop.

MILLING MACHINES

1—BROWN & SHARPE No. 37 duplex.
6—B. & S. Nos. 2, 3-B, 4-B, 5-B Pl.
10—CIN. Nos. 1½, 2, 3, 3-S, 4, 5 Pl.
1—LEBLOND No. 4-G Pl.
1—R. & S. No. 1½ Univ.
1—KEMPSMITH No. 3 Univer.
1—LEBLOND No. 3 Univer.
8—BRIGGS Type "A" Mfg.
1—BRIGGS Type "B," 72" table.
1—INGERSOLL 24"x24"x10'.
13—BECKER Nos. AB, C1, 6 Ver.
7—P. & W. 4½x12, 6x14, 6x48, 6x80 Thread.
4—P. & W. 5", 8", 10", 12" Auto.

LATHES

2—HENDEY 16"x6', 16"x8' grd. bd.
2—SEBASTIAN 18"x5'.
2—SPRINGFIELD 18"x10'.
1—LEBLOND 23"x10'; SPD.
1—REED PRENTICE 24"x12' M D.
1—LEBLOND 36"x30' triple gd.
1—McCABE 48" dble. spdle.
1—BOYE & EMMES 24"x12'.
1—LEBLOND 25"x16'; cone dr.
3—LEBLOND 26"x10' Dupl. Crank.
1—REED PRENTICE 27"x12' SPD.
1—P.E. REED 32"x27'.
1—NILES 38x24'.
1—N.B.P. 42"x24'.
7—LEBLOND No. 12 Multicuts. Lathes of all sizes and types.

AUTOMATIC SCREW MACHINES

14—CLEVELAND ⅝", ⅝", ⅝", 1¼" "A."
4—CLEVELAND ⅝", ⅝", ⅛", 1¼" "B."
17—GRIDLEY ⅝", ⅞", 1¼", 1⅜", 1⅝", 2⅛" 4-spindle.
11—GRIDLEY 3¼", 4¼", 2¼" single spdle.
6—NEW BRITAIN Nos. 23, 24, 33.
3—NATL. ACME Nos. 52, 56, 515.
11—P. & J. Nos. 5-A, 6-A.

TURRET AND SCREW MACHINES

1—ACME Fox Monitor.
1—FOSTER Nos. 2, 4, 5, 6.
1—GREENLEE 2¼x26.
2—ACME 3¼x36.
10—J. & L. 2¼x24, 3x36.
3—STEINLE 24" Turret.
2—LIBBY 18" Turret.

PLANERS

1—DETRICK & HARVEY 30x10', single hd. Openside.
1—DETRICK & HARVEY 96x48x20' open side.
1—GRAY 38x38x20', 3 heads.
1—CINCINNATI 48x48x16', 4 hds.
1—GRAY 48x48x12', 2 hds.
1—DETRICK & HARVEY 48"x96"x20' MD, 3 hds.
1—GRAY 60"x48"x12', 2 hds.
1—POND 72x72x20'; 4 heads.

SHAPERS AND SLOTTERS

1—POTTER & JOHNSTON 15" shaper.
1—GOULD & EBERHARDT 16" shaper.
1—GOULD & EBERHARDT 24" shaper.
1—NILES 20" shaper.
1—NILES 18" Slotter.
1—BEMENT 20" Crank Slotter.
1—BEMENT 36" Crank Slotter.

MISCELLANEOUS

LAPOINTE Broaches (Hudson & New London) 1, 2, 3 and 4.
1—LAIDLAW, DUNN & GORDON 17x16 Air Compressor.
3—CLAYTON Air Compressors.
3—KELLER E-3 Engravers.
1—GORTON No. 1-D Engraver.
5—FISCHER No. 1 Oil Groovers.
1—ESPEN LUCAS 44" Cold Saw.
1—CAMPBELL 3/16" Nibbler.
1—ALLEN 16' Reach Port Rivetter.
1—NILSON 3-slide Wire Former.
1—SHUSTER ¼" Wire Straight.
1—SOUTHWARK Hydraulic Bending Roll.
1—WICKES Single End Punch.
1—MURCHEY duplex Nipple Cutter.
1—GARVIN 24" Cam Cutter.
1—NILES 400 ton Wheel Press.
2—FERRACUTE C-4, C-5 Press.
1—BLISS No. 1 Toggle.
2—BLISS No. 20
1—V & O No. 62

MOREY AND COMPANY, INC.

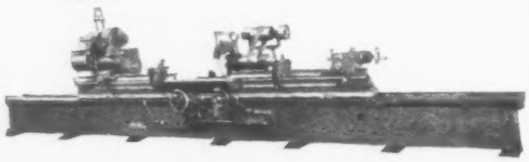
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NEW YORK, N. Y.
Telephone, Canal 5360

• BATH *Cleveland* •

HEAVY MACHINE TOOLS

SPECIALS

72″ x 72″ x 20′ Pond 4-head Planer. Reversing motor drive. Rapid Traverse



20″ and 24″ x 144″ Norton M. D. Grinders

6′ American triple purpose radial drill. Gear box or motor drive

BORING MILLS, 24″ to 24′. Horizontal up to 6½″.

PLANERS up to 96″.

FORGING MACHINES up to 4″.

COLD HEADERS up to ¾″.

BOLT AND NUT MACHINES
Tappers, Bolt Cutters, Wire Straighteners and Nut Machines.

DRILLS
Upright, Radial and Multiple Spindle.

LATHES, 16″ to 42″.
Milling Machines, Punches and Shears, Brakes, Riveters, Rolls, Slotters, Turret Lathes and various other Machine Tools.

CYRIL J. BATH & CO. 6982 Machinery Ave. CLEVELAND, O.

Phone: HENderson 8976
Cable Address: BATHCO

10 YEARS YOUNG

Air Compressors

1—1050 cu. ft. Worthington 18″ and 11″x14″ Duplex, Two Stage, Feather Valve, with idler.
1—529 cu. ft. Ingersoll Rand, Class Er-1 14″x10″, with idler.
1—265 cu. ft. Worthington, 9½″x12″, with idler.
1—188 cu. ft. Penn. 9″x8″ with idler.

Boilers

2—500 H.P. Heine Water Tube, ASME Code, with Stokers, 160 lbs. (Battery of two).
1—400 H.P. B. & W. Water Tube, ASME Code, 200 lbs.
1—175 H.P. 72″x20′ Coatesville HRT, ASME Code, 150 lbs.
1—125 H.P. Erie City Economic, ASME Code, 150 lbs.
1—100 H.P. 66″x16′ Ames HRT, ASME Code, 125 lbs.
1—100 H.P. Erie City Locomotive, Non-code, 105 lbs.
1—80 H.P. Locomotive, Mass. or N. J., 125 lbs.
1—40 H.P. Ames Empire, ASME Code, 100 lbs.

Bolt and Pipe Machines

1—2″ Landis Single Head Bolt Cutter, with both bolt and pipe dies.

ON November 11, 1929, we celebrated the 10th year of our entry in the machinery field. We started with high ideals in merchandising—we have always maintained them and as long as we are an organization they will be our first consideration.

We thank you for all past patronage and hope to merit a continuation of same during 1930.

1—6″ Williams Pipe Machine, capacity 2½ to 6″ inc., single pulley drive.
1—12″ Williams Pipe Machine, capacity 2½″ to 12″ inc., single pulley drive.

Drills

1—24″ Cincinnati Bickford S.H.
1—26″ Prentice S.H., single pulley drive.
1—48″ Western Plain Radial Gear Box Drive.
1—No. 5 Fox Multiple Spindle.
1—Four Spindle Henry & Wright Hi Speed, ball bearing.

Lathes

1—14-16″x8′ American Q.C.G.
1—16″x6′ Lodge & Shipley, Patent Head, taper attach.
1—16″x8′ Monarch D.B.G., Q.C.G., taper attach.
1—18″x21′ Hamilton.
1—19″x14′ LeBlond Heavy Duty, Q.C.G., motor driven.
1—20″x8′ Monarch D.B.G., Q.C.G.

Tool Room Tools

1—16″x6′ Hendey enclosed belted motor drive with motor. Serial No. 25988.
1—15″ Potter & Johnson Shaper.
1—No. 2 Brown & Sharpe Surface Grinder.

DELTA EQUIPMENT COMPANY

148 N. Third Street, Philadelphia, Pa.

SIMMONS "RESTORED" MACHINES

A few selections from our stock of 2,000 guaranteed "Restored" machines

MILLERS

1—No. 2 Brown-Sharpe Vertical
5—No. SB Becker Continuous
3—No. CS Becker Continuous
1—No. 4-B Milwaukee Vertical
1—No. 4 Cincinnati Vertical
1—No. 3 Cincinnati Vertical
1—No. 5 Brown & Sharpe Vertical
2—No. 14 Garvin Vertical
9—No. 20 Garvin Vertical
1—No. 4 Cincinnati Universal
1—No. 6 Cincinnati Universal
1—No. 1½ Hendey Universal
1—No. 1-B Milwaukee Universal
1—No. 25 Ohio Universal
1—No. 4 Cincinnati Plain
2—No. 3 Kempsmith Plain
1—No. 3-B Milwaukee Plain
5—No. 3 Cincinnati Plain
2—No. 3 LeBlond Plain
1—No. 2 Cincinnati Plain
1—No. 1½A Milwaukee Plain
1—No. 1A Milwaukee Plain
2—No. 1½ Brown-Sharpe Plain
1—No. 1-B Fox Plain
1—72x72x24' N-B-Pond Plain Type
2—66x62x15' Ingersoll Plain Type
1—59"x20"x12' Ingersoll Plain Type
1—50"x40"x12' Newton Pl. Type
1—48"x48"x12' Ingersoll Adj. Rail
1—48"x42"x8' Ingersoll Adj. Rail
1—40"x22"x6' Ingersoll Pl. Type
1—32"x28"x10' Ingersoll Pl. Type
3—No. 7-H Becker-Lincoln
1—No. 3½ Pratt-Whitney Duplex
1—No. 2 Garvin Duplex
1—28" Cincinnati Automatic
2—18" Cincinnati Automatics
1—No. 3 Lees-Bradner Thread
1—12" P. & W. Whitney Automatic

GEAR MACHINERY

9—18" Gleason Generators
1—24" Gleason Planer
1—No. 12-H G. & E. Hobber
1—No. 24-H G. & E. Hobber
1—No. 36-H G. & E. Rack
1—No. 3 Barber-Colman Hobber
1—No. 12 Barber-Colman Hobber
1—No. 96-H G. & E. Hobber
1—No. 13 B. & S. Spur-Bevel
1—No. 1 Standard Automatic
1—No. 3 Cincinnati Automatic
1—No. 4 Cincinnati Automatic
1—36" G. & E. Automatic
1—90" Pratt-Whitney
1—No. 6 Fellows Shaper

LATHES

7—14" Fay Automatics.
1—90" Putnam Wheel
1—82"x36' Pittsburgh
1—72"x56' N-B-Pond
1—66"x21' Pittsburgh
1—50"x36' Pittsburgh
1—48"x22' N-B-Pond
1—48"x14' N-B-Pond
6—42"x39' Putnam
1—42"x24' N-B-Pond
1—36"x36'.Putnam
1—36"x14' Bridgeford
1—36"x14' Putnam
1—30"x14' Pond
1—30"x12' W-Blaisdell
1—28"x18' Schumacher-Boye
2—26"x12' N-B-Pond
2—25"x12' LeBlond
2—24"x18' Reed
1—24"x14' Reed-Prentice
1—24"x12' Prentiss
1—24"x10' LeBlond
1—20"x10' Flather
1—26"x24' G-Klusman Grd. Head
1—20"x20' Reed
1—18"x10' Mueller
1—18"x10' Lodge-Shipley
1—17"x10' LeBlond
2—17"x8' LeBlond
1—16"x16' Greaves-Klusman
1—16"x8' Hendey
1—16"x8' G-Klusman
3—16"x5' Monarch
1—14"x6' American
1—12"x5' LeBlond
1—8"x60" Le-Swing

PLANERS

1—10'x10'x20' Bement M.D.
1—10'x6'x16' N-B-Pond M.D.
1—72"x72"x18' D. & H. Openside
1—72"x72"x16' Cleveland Openside
1—60"x60"x14' Powell M.D.
1—48"x48"x14' W-Powell M.D.
1—48"x48"x12' N-B-Pond M.D.
1—48"x42"x12' D. & H. Openside.
1—36"x36"x14' N-B-Pond
1—36"x24"x12' D. & H. Openside
1—36"x36"x10' Gray M. Drive
1—36"x36"x10' W-Powell
1—36"x36"x10' N-B-Pond
1—30"x30"x18' Cincinnati
1—30"x30"x12' N-B-Pond M.D.
1—26"x26"x6' Gray Planer
3—24"x24"x10' W-Blaisdell
1—24"x24"x8' Cincinnati

DRILLS

1—7' Dreses Plain Radial
1—6' Bickford Plain Radial
1—6' American Universal
1—5' N-B-Pond Universal
1—5' Western Plain Radial
1—5' Cin-Bickford Plain
2—4' Cin-Bickford Plain
1—3' American Triple Purpose
1—3' American Plain Radial
1—3½' American Plain Radial
1—4' Bickford Plain Radial
3—No. 4-D Colburn Heavy Duty
2—No. 2-D Colburn Heavy Duty
1—No. 1-D Colburn
1—No. 310 Baker Heavy Duty
1—42" Cin-Bickford S. Head
1—34" Prentiss Sliding Head
1—30" Snyder Sliding Head
1—28" Prentiss Sliding Head
1—24" Aurora Sliding Head
2—No. ½ Avey BB Bench
1—No. 2 Avey High Speed
1—No. 2 Allen High Speed
1—No. 2-B Edlund Two Spindle
2—23" Rockford Three Spindle
2—23" Rockford Four Spindle
1—Four Spindle L. Gifford BB
1—Four Spindle Avey No. 2
1—7-spindle H. & Wright Class B
1—No. 4 Baush Multiple
1—No. 11-D Moline Multiple
1—No. 15 Natco Multiple
1—No. 30 Natco Multiple
1—24" G and E Shaper
1—24" Simmons
1—10" Dill Slotter
1—15-18" Dill
1—15" Newton
1—20" Bement

BORING MILLS

1—14' Niles Heavy, Vert.
1—12' Niles Extra Heavy Vert.
1—10-16' Niles Extension Vert.
1—100" Sellers Vert.
1—90" N-B-Pond Vertical
1—72" N-B-Pond Vertical
1—62" N-B-Pond Vertical
3—44" N-B-Pond Vertical
1—44" Putnam Vertical
1—42" Bullard Rapid Production.
1—24" Bullard Rapid Production
1—36" Bullard Rapid Production
1—No. 1 D & Harvey Horiz.
1—No. 3 Barrett Horizontal
1—5½" Bar Betts Horizontal
1—6" Bar Espen Lucas Horiz.
1—7" Bar Newton Horizontal

TURRET LATHES AND SCREW MACHINES

1—4½x30 Bardons & Oliver Turret
1—3x36 Pratt & Whitney Turret
1—2½x26 Pratt & Whitney Turret
3—2¼x26 Acme Turret
4—2-A Warner-Swasey Turret
4—No. 4 Warner-Swasey Turret
1—No. 6 Woods Tilted Turret
1—26" Libby Turret
4—18" Libby Turret
1—26" Gisholt Turret
1—24" Gisholt Turret
1—1½x8 Millholland
2—1½x9 Acme Turret
2—2x24 Jones-Lamson Turret
1—No. 4 Warner-Swasey Universal
1—No. 6 Warner-Swasey Turret

SHAPERS and SLOTTERS

1—14" Rockford Shaper
1—15" Potter-Johnson Univ.
2—16" Stockbridge
1—18" Smith-Mills
1—20" Stockbridge
1—20" Kelley
1—20" American

SOLD UNDER MONEY BACK GUARANTEE—ASK FOR OUR 160 PAGE CATALOG.

SIMMONS MACHINE TOOL CORPORATION

BUFFALO, 88 Exchange Street ALBANY, 1700 Troy Road NEW YORK, 149 Broadway

MILES' REBUILT AND GUARANTEED TOOLS PRODUCE LIKE NEW

OPENSIDE PLANERS

30"x30"x8' CLEVELAND. 1 rail & 1 side head.
30"x30"x12' CLEVELAND. 1 rail & 1 side head.
42"x36"x16' CLEVELAND. 2 rail & 1 side head.
42"x42"x12' CLEVELAND. 2 rail & 1 side head.
Belt or motor drive.

AUTOMATICS

1"x5" and 1⅝"x7" NEW BRITAIN, 6 spindle (2).
2¼", No. 56 NAT'L ACME, 4 spdle.
⅜", 1¼", 1¾" and 2¼" GRIDLEY, 4 spindle.
No. 55 NATIONAL ACME, 4 spindle, cut-off machine.
1", No. 53 NATIONAL ACME, 4 spindle (4).
3¼" GRIDLEY, single spindle.
14" BULLARD, mult-au-matic.
14" FAY, chucking.
HARTNESS, tilted automatic.
Nos. 5A and 6A POTTER & JOHNSTON.
No. 22 NEW BRITAIN, chucking

AIR COMPRESSORS

3200' GENERAL ELECTRIC, motor driven centrifugal.
590', 14"x15" UNION, class BL, bel. driven.
590', 14"x14"x15" UNION, class SL, steam driven.
355', 12"x10" INGERSOLL-RAND, type E.R.1.
139', 9"x9" CURTIS, vertical duplex.
100', 8"x8" CHICAGO PNEUMATIC TOOL CO.
140', 8"x6" GARDNER, vert. duplex.
92', 7"x6" INGERSOLL-RAND, type E.R.1 (3).
80', 6"x3" GARDNER, vert. duplex.

DRILLS, RADIAL

3' AMERICAN, sensitive.
3' AMERICAN, heavy duty.
3' MUELLER.
3½' MORRIS.
3½' BICKFORD.
4' HAMMOND, hinged arm, sensitive.
5' WESTERN, heavy duty.
6' WESTERN, heavy duty.
6' NILES-BEMENT-POND, full univ.
8' WESTERN, heavy duty.

GEAR CUTTERS

6" GLEASON, bevel gear generator, straigh path.
6"x3½" BILTON, automatic.
No. 12 BARBER COLMAN, arranged for spline milling.
No. 12 BARBER COLMAN, hobbers.
12", 18" and 24" GOULD & EBERHARDT, hobbers.
14", No. 5A LEES BRADNER, hobber.
12" INGLE, gear tooth rounder.
15" GLEASON, bevel gear quenching machine.
18" CINCINNATI, gear hobber.
GLEASON, 15" spiral gear cutter grinder.
48"x10", 60"x11" and 70"x20" GOULD & EBERHARDT, auto. spur.
26" CINCINNATI, automatic spur.
48" BROWN & SHARPE, auto. spur.

GRINDERS, CYLINDRICAL

8"x18" OTT.
8"x18" and 12"x24" MODERN.
9"x20" FITCHBURG, Model A.
10"x30" TAFT PIERCE, universal.
10"x30" No. 2 WEBSTER & PERKS, universal.
10"x48" BROWN & SHARPE, No. 14.
12"x18" CINCINNATI.
12"x60" MODERN, self con ained.
LANDIS, 6"x18", 10"x20", 10"x24", 10"x36", 10"x52" and 12"x72".
NORTON, 6"x32", 10"x24", 10"x36", 14"x50", 14"x72", 12"x36" CINCINNATI, universal.

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600 lb. NILES BEMENT POND, steam forging.
40 and 100 lb. BRADLEY, cushioned helve.
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Nos. 50 and 60 NEW BOYER, air riveting.
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PETTINGELL bumming, Nos. 1 and 2.
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⅜". No. 0 MITTS & MERRILL.
1" No. 0 BAKER.
1½" No. 1 BAKER.
1¼" No. 2 MITTS & MERRILL.
2½" No. 4 MITTS & MERRILL.

LATHES, ENGINE

Brand new CISCO geared head, sizes: 14"x6', 16"x6', 18"x8', 18"x8' and 20"x8'.
18"x7' SOUTH BEND, LCG.
16"x8' LODGE & SHIPLEY.
16"x8' NATIONAL, QCG, DBG.
18"x8' WILLIAMS, semi QCG.
18"x8' SCHUMACHER-BOYE, QCG, DBG.
18"x8' BRADFORD, QCG, BG.
18"x8' MONARCH, QCG, BG.
20"x10' CISCO, QCG, BG.
20"x8' LEBLOND, QCG., DBG.
22"x10' BRADFORD, semi QCG, DBG.
22"x10' DAVIS, QCG, DBG.
24"x10' CARROLL-JAMIESON, semi QCG.
24"x10' WICKES, LCG, DBG.
24"x12' BRADFORD, semi QCG, DBG.
24"x12' MILWAUKEE, semi QCG, DBG.
24"x12' LEBLOND, LCG, SBG.
26"x14' PUTNAM, semi QCG, DBG.
27"x12' SCHUMACHER BOYE, quick change gear, DBG.
29"x12' SCHUMACHER BOYE, QCG, DBG.
32"x14½' SCHUMACHER BOYE, LCG, DBG.
36"x16' JOHNSON, triple geared, quick change, MD.
36"x18' SCHUMACHER BOYE, quick change gear, triple geared.
48"-58"x20' NEW HAVEN, QCG.
50"x16' PITTSBURGH, triple geared, QCG.

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24" BULLARD, with turret & side hd.
36" BULLARD, with turret & side hd.
36" NILES.
42" BULLARD.
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84" NILES TOOL WORKS.
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3" bar, No. 3A UNIVERSAL.
3" bar, FOSDICK No. 0.
6" bar, GRAY MACHINE TOOL CO.
6" bar, PEDRICK, floor type.

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Nos. 1½, 2, 2 heavy and 3 BROWN & SHARPE.
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Nos. 1½AS MILWAUKEE.
No. 25 BECKER.
No. 2S OHIO (Oesterlein).
No. 1½ ROCKFORD.

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1½", 2", 2½" and 3" ACME.
2" ACME, 2 spindle, LANDIS die heads.
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⅝" GEOMETRIC, with 1" die head.
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3" LANDIS, 2 spindle.

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4' Dreses High Duty Plain Radial, G.B.D.
2' American High Duty Plain Radial, C.P.D.
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34", 28", 26" and 22" W. F. & John Barnes Upright Drills (latest type).
26" Barnes All Geared Drill.
25" and 21" Weigle Upright Drill (latest type).
24" Cinti-Bickford Upright Drill—Tapping Attach.
No. 217, No. 310 and No. 314 Baker Bros. H.D.D.
No. 2 Foote-Burt 6 Spdle. H.D.R.D.
21" Hoefer 6 Spdle Gang Drill.
Allen 1, 2, 3 and 4 Spdle B.B. Drills—No. 2 M.T.
Leland & Gifford 2 spdle B.B. Drill, No. 2 M.T.
No. 3 Baush Multiple Drill equipped with 19 spdl. (late type)

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36"x38" Bridgeford Geared Head Q. C. Lathe—Arrged for M.D.
36"x18' Lodge & Shipley Q. C. Lathe.
30"x26' Niles-Bement & Pond.
Stand Chge Lathe.
26"x12' Pittsburgh Q. C. Lathe.
24"x14' and 24"x12' Cisco Geared Head Q. C. Lathes (brand new).
24"x10' Boye Emmes Q. C. Lathe.
20"x8' Hendey Geared Head Q.C. Lathes—Taper At.
18"x10' American Geared Head Q.C. Lathe.
18"x8' Mueller Q.C. Lathe—Taper Attach.
16"x10' Lodge & Shipley Q.C. Lathe—Taper Attach.
14"x6' American Hi-Duty Q.C. Lathes.
3¼"x36" Acme Geared Head Turret Lathe—Chuck Equip.
3"x36" Jones & Lamson Turret Lathe Chuck Equip.
3¼"x40" Greenlee Turret Lathe—Bar Equip.
No. 4 and No. 7 Bardons & Oliver Turret Lathes.
No. 2 and No. 4 Millholland Turret Lathes.

MILLING MACHINES

No. 3 and No. 2 Brown & Sharpe Universal—C.P. Complete.
No. 1-B LeBlond Universal—C.P.—Complete.
No. 1 Owen Universal—C.P.—Complete.
No. 4 Cincinnati H.P.P.—Arrged for M.D.—P.R.T.
No. 3 Brown & Sharpe Plain—C.P.—P.R.T.
No. 3 Hendey-Norton Plain—C.P.
No. 3, No. 2 and No. 1½ LeBlond Plain—C.P.
No. 2-H and No. 1½ Brown & Sharpe Plain—C.P.
No. 2 LeBlond Plain—C.P.
No. 5-C Becker Vertical Miller.
Becker Model "C" Vert. Continuous Miller.
28" Cincinnati-Semi-Automatic Duplex Miller.
14" Cincinnati-Semi-Automatic Miller.
18" Cleveland Plain Mfg. Miller.
No. 6 Whitney Hand Miller.

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24" Gould & Eberhardt Hi-Duty B.G. Crank Shaper—M.D. thru Gear Box—(Late Type)
24" Stockbridge Hvy Duty B.G. Crank Shaper—Power Down Feed.
24" and 16" Barker B.G. Crank Shaper.
24" and 20" Kelley Hvy Duty B.G. Crank Shapers.
20" Cincinnati Hvy Duty B.G. Crank Shaper.
20" Milwaukee Hvy Duty B.G. Crank Shaper.
20" American Hi-Duty B.G. Crank Shaper—S.P.D.
16" Hollingsworth Hvy Duty B.G. Crank Shapers.
16" Columbia Hvy Duty B.G. Crank Shaper—Arrged for M.D.—Revolving Table.
24" Cincinnati Crank Planer—One Head.
30"x30"x10' American Planer—One Head.
42"x42"x10' G. A. Gray Planer—One Head.
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No. 6 and No. 61 Fellows Gear Shapers.
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No. 5 48" and No. 3 26" Brown & Sharpe Auto Spur Gear Cutters.
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12" Pearsons-Arter Rotary Surface Grinder.
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No. 4 23" and No. 8 40" Gardner Disc Grinders.
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No. 2½ Bath Universal Grinder—Complete.
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MISCELLANEOUS

No. 2½ Universal Horiz. Boring Mill—2½" D.B.
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30" Gisholt Vert. Boring Mill—Turret Head—P.R.T.
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No. 20 Bliss O.B.I. Power Press.
No. 511-E Toledo Power Gap Shear—Cap. 73" lg. by 11 Ga.
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All machines in exceptionally fine condition.

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(All Lathes except 4—quick change.)

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24"x24"x8' Cincinnati 1 head.
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42"x42"x12' W.P. 4 Heads.
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OPENSIDE PLANERS
D. & H. 30"x10'-8'.
D. & H. 42x16.
D. & H. 36"x12'-8'.
D. & H. 48"x16'.
D. & H. 48"x84"x20'.
D. & H. 96"x72"x24'.
Cleveland 30"x12', 36"x12', 36"x-48"x10', 72"x20'.

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12", 14", 16", 24" Hendey.
18"x10' Johnson geared head.
1—90" Lathe 20' Centers, belt drive.

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Gisholt, Foster, Libby, Warner Swasey, Gridleys. (3).

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48x72x14' Harrington.
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26x48x14'-20', 18'-22'.
26x48x12' taper.

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Face—Diamond 30"x84" (3).
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No. 5 H.&J. single end motor dr. 56".
72" H. & J. Punch, 1⅛x1⅛.
60" Massilon single end 1½"x1".
48" Whiting single end 1¼"x1".
36" H. & J. No. 3 sgl. end 1¼" x 1".
30" L. & A. No. 4 single end 1"x1".
⅜" Lennox Bevel Shear
⅜" Lennox Splitting Shear.
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⅛" Kling Universal Plate Shear.
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Niles 16'-19'.

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1—96" 3/16" plate.
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1—96" 5/16" plate.

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10' for ¾" plate.
7' for ⅞" plate.
8' for ⅞" plate—8"—⅛".

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Alligator type 2", 3", 4".
Bar type 2", 3", 4".
15 Power squaring Shears.
Angle 6"x6", 8"x8".
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3—10", 15", 18" Newton.
24" Slotter N.B.P.

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W. & W. No. 0, 1, 3, 4, 4B, 5, 8, 22, 25, 27, 29, 0.
Ajax No. 9.

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3½", 4", 4½", N.B.P. Dup. Control.
3" Universal.
2½", 3" Lucas.
3", 4" Lambert.
5" Beaman & Smith, Floor Type.
3½", 4", 5" D. H. Floor Type.

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25' Sellers 2 heads—motor.
14' N.B.P.

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B. & S. No. 5 vertical.
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Cincinnati No. 2, 3, 4, 5 plain.
Cincinnati No. 2, 3, 4 Universal.
B. & S. No. 2, 3, 4, 4B plain.
B. & S. No. 2, 3, 4 Universal.
LeBlond No. 3 plain cone drive.
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P. & W. 5" Automatics

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30x24x12 N.B.P. Motor "Slab"
24x24x14 Ingersoll Motor Rail type.
60x36x14 Ingersoll Motor Rail type.
38"x48"x8' Ingersoll Motor Rail type.
31"x36"x12' Ingersoll Motor Rail type.

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Single frame 200 lb. to 3000.
Double frame 750 lb. to 8000.
Steam drops 800 lb. to 6000.
Board drops 600 lb. to 3000.
Automatic drops (6).
Air, Nazel, 2, 3, 4, 7.
Bradley, all sizes.
Belt driven 50, 60, 100, 200, 500.

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1" Wells Single Head, 26 sets of dies.
2" Acme, single head, lead screw attach.

BORING MILLS
24" Bullard Production Type New Era Turret.
42" Gisholt Vertical, arr. for M.D.

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No. 5-D Moline, 6 spindle "Hole Hog."
2½" Bar Ber.ram, horizontal.
2½" Lucas horizontal, cone drive
3" Lucas horizontal, single pulley drive.

DRILL PRESSES
No. 0 and No. 1 Avey Bench, H.S.B.B.
No. 2 Avey, single spindle, H.S.B.B.
No. 1 Avey, 3-spindle, H.S.B.B.
Leland-Gifford, 1-spindle, H.S.B.B.
20" Barnes, W. & L. feed.
20" Cincinnati, tapping att.
22" Aurora, sliding head.
24" Rockford, compound table, Jig Borer.
32" Hamilton, sliding head, tapping att.
Namco, 5-spindle driller, semi-automatic.
Wes ern, 8-spindle driller.
D-66 Moline 4-spindle "Hole Hog."
D-4 Colburn heavy duty, comp. table.
Cleveland Post Wall Drills.

RADIAL DRILLS
2½' Mueller, single pulley drive.
3' Cininnati-Bickford, single pulley drive.
5' Pond, cone drive.
5' Cincinnati-Bickford, full Universal.
6' American, plain.

GEAR HOBBERS
No. 3 and No. 12 Barber Colman.
No. 36 B. G. E. Gear Rougher.

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10"x36" Norton Cam.
10"x50" Norton Plain
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No. 11 B. & S. 6"x32" plain (2).
No. 1 Dia. Sur.
30" Dia. Face Grinder. AC Motor Drive.

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200 lb. Bliss, board drop.
500 lb. Beaudry.
800 lb. Massilion, steam drop.
1200 lb. Bliss board drop.

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16"x6' LeBlond, quick change gear.
16"x6' Lodge & Shipley, taper.
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14"x8' American, motor drive.
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24"x18' American.
28"x12' Lodge & Shipley, crankshaft.
30"x14' Lodge & Shipley, cone drive.

MILLERS
No. 1½ Rockford, plain.
No. 2 Cincinnati, plain.
No. 6 Whitney Hand.
No. 3 LeBlond, plain.
No. 5-B Becker vertical, rotary table.
6"x80" P.&W. thread, belt drive.
Gooley & Edlund type "A" and "B."

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6" Landis.
6" Eaton, Coe & Burnham.

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16' No. 3 Niles.

PLANERS
32"x32"x8' Gray, one head.
36"x36"x14' Chandler, two heads.

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No. 3 and No. 4 American Can, horning.
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48" Rock River, cap 1 3/16" in 1".
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No. 2 Warner & Swasey.
No. 2 W. & S., set-over turret.
No. 11-S.P. Garvin
No. 5 and No. 6 Wood Tilted.
No. 52 and No. 53 Nat'l-Acme, automatics.
No. 1-B Foster.

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16" Cininnati, back geared.
16" Smith & Mills, back geared.
16" Gould & Eberhardt.
16" Milwaukee, back geared.
24" Milwaukee, back geared.

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6"x6"x⅞" cap., L. & A. double angle.
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42" Niagara, power gap, 16 gauge.

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TURRET LATHES
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With comp. rest, power cross feed, taper attachment and chucks.
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Inspection in operation in New York by appointment.
Also large stock overhead cranes and hoists

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7′ Dreses Univ. Radial; Tap Attach.
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Lysholm Table 51′3″ Long. A-1.
Electric Traveling Cranes to suit your span.

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Send for This New Stock List, No. 56

Our Tenth Birthday

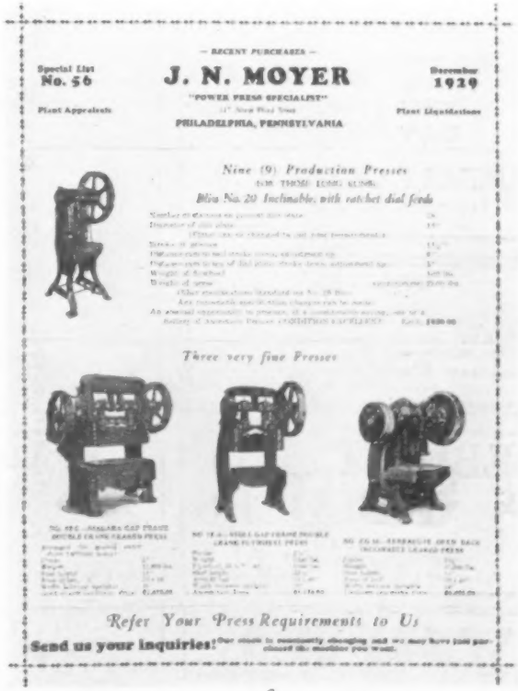
We are just completing our tenth year as MACHINERY DEALERS. Each year has added to our SUCCESS and each year has added new FRIENDS. To you, OUR FRIENDS, who have made possible our SUCCESS by your continued patronage, we express our THANKS and wish you the COMPLIMENTS OF THE SEASON. To others with whom we are not acquainted, we ask an opportunity to know you. It shall be our earnest effort to serve you.

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1—200	500	Westing.	CW
2—200	600	Fairbanks-Morse	BV
2—150	600	Gen. Elec.	M
1—100	900	Burke 2200 Volt	EMV
1—104	860	Gen. Elec.	M
1— 75	450	Burke Elec.	MMV
1— 40	860	Westing.	MW
1— 75	685	Westing.	MW
1— 40	860	860 Westing.	HF
2— 30	690	Westing. New	CI-638
1— 30	600	Gen. Elec.	M
1— 25	600	Gen. Elec.	ITC-M
1— 22	680	Gen. Elec.	ITC-5011
1— 20	1160	Westing.	CW-554

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160 cu. ft. I-R, XX, steel or rubber.
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10	27'-6"	Box	(3)—220-VAC.
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Heavy and Light
Send Drawings and Specifications for Estimate
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BORING MILLS
(Up to 16 feet)
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We have facilities to build machinery and are prepared to furnish proposals on parts or complete machines. We offer the services of our competent staff of designing Engineers for your problems.
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Catering especially to the machine tool trade. Your inquiries will receive prompt, careful attention.
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COMPETENT ENGINEERS
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OUR ENGINEERS WILL CALL ANYWHERE
Let us help you with your problems
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Machinery built with the same degree of accuracy as we put into our own Product.
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Engineers—Founders—Machinists
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Designers and Builders of
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Contract Manufacturing
Send Blueprints for Estimate
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Have a well equipped plant for the manufacture of medium and light weight machinery, tools, jigs, fixtures and special machine work including gear cutting.
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DESIGNED
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MACHINE PARTS — TOOLS
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We have capacity for a limited amount of additional medium weight machine work requiring accuracy. Pieces up to 5 tons.
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Heavy and light machine work, patterns, castings and forgings. Well equipped shop, efficient management, low overhead, fair prices. Send Blue Prints for Estimates, or ask to have representative call.
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Made from Pipe; Spacers, etc.
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Large or small quantities.
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Designed and built, or produced from customers' drawings. Production turning on Jones & Lamson and Potter-Johnston turret lathes. Gear cutting in all its branches.
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BUILT TO ORDER
We have splendid facilities for producing special machinery of all kinds and we are prepared to guarantee satisfaction both as regards workmanship and price. We have foundry facilities and an up-to-date machine shop. Send us blueprints and give us an opportunity to quote you price. We can save you money.
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Engineers and Tool Makers
High quality time saver tools, dies, jigs and special machinery built to order.
Send your samples or blue prints for our estimate.
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We offer unusual service to anyone requiring special machinery or production facilities on a contract basis. In addition to a very complete manufacturing plant that includes gray iron, steel and brass foundries, also pattern, structural, machine and forge shops, we have a skilled staff of Engineers—both mechanical and chemical, engaged in development and research. Our engineers will be glad to work with you in solving your special problems.

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Facilities above the average. Write us for quotations.
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Metal Goods—Special Machinery
Production facilities for stamping, press work, machining, welding, japanning, assembling and sheet metal work.
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We specialize in designing stampings to substitute castings. Dies designed and built for quantity production.
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Stamped and Drawn Parts to order
'Made from Stanley Steel'
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THE ROBINSON TOOL WORKS, Inc.
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Let us make your stampings, sheet metal working dies, jigs, fixtures, tools, etc.
Our work is right—our price is right.
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Send prints for estimates on all kinds of sheet metal work; riveted or welded construction up to ⅝" plate; also metal spinning.
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PRESS WORK—HOT or COLD
With a Service That Satisfies
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Inquiries Solicited
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We fabricate black and galvanized sheet metal for every industrial use. Send blue prints for estimates.
Steel Buildings, Roofing, Siding, Ventilators
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We have unusual facilities for handling all types of sheet steel drawn or stamped work. Let us quote on your requirements either in plain steel or enameled finishes.
Estimates given from blue prints, samples or complete description.
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Diameter up to 1¾". Large battery of automatics available. Send blue prints or samples for quotations. Accurate workmanship. Good delivery.
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ALL SIZES
Complete Finishing Facilities
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Capacity 3"
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Producers of Screw Machine Products for Aircraft, Automotive and Allied Industries.
Completely equipped for finishing operation, including Hardening Plant for treatment of all kinds of Alloy Steels, making effective the maximum strength of the steel specified.

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All kinds Screw Machine and Drill Press Work taken on contract.
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GREY IRON
Machinability—Wear—High Strength
Heat Resisting
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THE HENDEY MACHINE CO.
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LIGHT GREY IRON CASTINGS
WE GUARANTEE
QUALITY, SERVICE
LOW PRICES
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Castings that must stand up under severe wear conditions. Outwears ordinary cast iron three to one. Held within close Brinell limits. Take up with us regarding any item where wearing quality is a requirement.

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Let Us Make Your
GREY IRON CASTINGS
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MACHINE WORK
on Contract
WE KNOW HOW
Would Appreciate Opportunity of Quoting
ROYERSFORD FOUNDRY & MCH. CO.
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WOOD *and* METAL
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Aluminum Matchplates
Send Blueprints for Estimates
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Reasonable Prices; Prompt Deliveries
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Light and Medium Stampings
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We have a large, well-equipped, modern foundry, economically manned for the manufacture of all styles of Grey Iron Castings, large or small, and are in position to quote attractive prices.

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IRON AND STEEL WORKS

in Middle Western Canada open to manufacture in Canada for American concerns.

Have well equipped steel, iron and brass foundry, pattern, machine, blacksmith, boiler, tank, structural and ornamental iron shops.

Highest Banking and Mercantile references. If interested.

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Grey Iron Castings
of all descriptions
our own pattern
and machine shop.
EYSTER, WEISER COMPANY
Established 1832
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We are in a position at this time to name some mighty attractive prices and delivery. Any size from any steel.
Allowing us an opportunity to quote will not be regretted.

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Gray Iron, Semi-Steel
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Adequate shop facilities, extensive experience, with the ability to take care of your pattern and machining requirements, put us in position to guarantee satisfaction on any job we undertake. Prices will be right, also.

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LET US SUPPLY YOUR GREY IRON CASTINGS

We guarantee to please. We have the facilities to turn out first class work at low prices. We use no scrap iron in our mixtures.

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Plate, Structural, Machine, Bulldozer and Hammer Forgings

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Grey Iron Castings from ½ lb. to 1000 lbs. of superior quality. Let us quote on your requirements.

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Angles, tees, channels, rounds and all bar shapes. Garbage and ash cans, steel barrels, castings (malleable, steel and gray iron). Carload shipments to our own siding via Erie R. R.

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Charcoal "Mayari" and low phos. mixtures. Quality castings for machinery, blank gears, dies, piston rings, etc.
Up to 1½ tons.

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AS CAST OR MACHINED COMPLETE
Metal Assemblies of all Kinds.
The ATLAS BRASS FOUNDRY CO.
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BRASS AND BRONZE CASTINGS
1 lb. to 2000 lbs.
Capacity 16,000 lbs. per day
OUR SPECIALTIES
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We have the largest hot dip galvanizing plant and kettles in the United States. We have the most modern equipment to do first class galvanizing at lowest prices.
Prime Western Zinc used exclusively. Galvanized products furnished.
Send Us Your Inquiries.

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Small Grey Iron Castings
(SOFT)

For quantity production; *easily machined.* Nickel chromium or manganese alloys if desired. Estimate?

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Complete facilities for furnishing to special analysis in grey iron or semi-steel

HEAVY CASTINGS
MACHINE WORK

of all descriptions to your design and requirements.

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HEAVY CASTINGS

"Mixtures for all purposes."
We do Special Machine Work up to large jobs and work to close limits when necessary.

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CATTIE BROTHERS CORPORATION
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Galvanized Angles, Cut to Length and Punched Carried in Stock:
Galvanized Bars, Channels, Ovals, Half Ovals, Bolts, Spikes and Other Materials.
Tioga, Sepviva and Witte Sts.,
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Our Specialties—Grey Iron Castings

Superior quality, machine or hand moulded, sand blasted, pickled or tumbled. On good tonnage we will make special moulding equipment that will warrant you the best price and most efficient service. Patterns made of wood, brass, aluminum or iron.

Grinding wheel machinery, hack saw machines. Huntington emery wheel dressers and cutters, drill press vises, wire rod cutters.

NORTH WALES MACHINE CO., INC.
North Wales, Pa.
22 Miles from Philadelphia, Pennsylvania

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ABSOLUTE BARGAIN
MONTREAL
MODERN SOLID BRICK FACTORY
(Sprinkler System—Elevator—Heating Equipment)
RAILWAY SIDING
Nearly 40,000 ft. floor space.
Room for Expansion.
Plentiful and Cheap Labour.
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Appraised at $247,000.
Will accept half this figure.
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Factory for small industry, 2000 sq. ft., near main line P. R. R., 30 miles to New York, 60 miles to Phila. Boats to N. Y. 500 ft. from Lincoln Highway.

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Large Factory Building

8000 sq. ft. built very strong for heavy manufacturing purposes, including Railroad Siding, and 125-horse power steam engine, boiler and machine shop. An ideal place for any kind of manufacturer. Immediate possession.

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for Sale or Lease . . .

NEWLY BUILT and equipped two years ago fifty miles from Birmingham, Ala. Six acres ground, two railroad sidings, 25,000 square feet floor space; No. 5 Whitney Cupola, No. 5 Root Blower Motor Driven, modern jarring machines. Core oven, cleaning and gapping equipment. New patterns for New York City Water Fittings 4" to 36".

Appraisal value replacement $75,000. Will sell for less than one-half this value or lease reasonable for term of years to responsible parties. For further particulars

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A profitable and well-established Pacific Coast factory, making a nationally known line of machinery and maintaining branch warehouses in Chicago and Philadelphia, is desirous of getting in contact with Eastern parties who are seeking to buy outright a plant having a meritorious product with unlimited possibilities. Investment approximately $85,000 with no real estate involved. All clean merchandise with limited amount of equipment. Reason for selling is that expansion seems desirable and as majority of product is sold east of Mississippi River, factory should be located in the East. Might consider merging with a profitable and well-managed Eastern factory, or, if desired, might retain an interest under proper conditions. Confidential correspondence invited with responsible Eastern principals only.

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BUSINESS OPPORTUNITIES SECTION

ALL CAPITAL
. . . . . is not speculation mad

Almost every week finds someone offering capital in these columns for the development of legitimate business. Every week finds others seeking capital for the production of new articles, for expansion, for improvement.

Here, then, is the logical mart of exchange for those looking for opportunities in the metal working industries. The variety of these offerings is indicative of the breadth of interest the section affords.

Whatever you have or want, tell your industry about it here.

Others find it economical and effective.

MACHINE SHOP AND FOUNDRY WANTED

We want to contract to have manufactured for us machines weighing 10 tons. Prefer company willing to help finance sales so as to increase volume to 100 machines annually.

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FINE ONE STORY BRICK FACTORY IN KOKOMO, IND.
200,000 Sq. Ft. Floor Space

all daylight; sprinklered; track; beautiful administration building. Wonderful buy at unbelievably low price. Get particulars quick.

FANTUS FACTORY LOCATING SERVICE
139 North Clark St., Chicago

FOR SALE

Factory Building, 55'x150' located on approximately one acre of ground. Has concrete floor, is well lighted and can have P.R.R. connection. Equipped with heating plant. Location Southern Pennsylvania.

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with principals who have machinery manufacturing business needing a modern machine shop for its production or a used machinery business requiring warehouse and shop for rebuilding. Location Central Pennsylvania. Might assist in additional financing if required.

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Free industrial sites, trunk line railroads, good water. Write Industrial Secretary, Box 444.

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The whole or part interest in a small tool plant (no real estate) with valuable patents. The tools are standard and are sold all over the world to factories and to the hardware trade both.

This can be bought at a bargain owing to change in partnership. A fine line to add to your present line, or for any one who wants a good profitable business. Could be merged with other small plants.

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INDUSTRIAL PLANTS ROLLING MILLS *and* EQUIPMENT
FRANK B. FOSTER
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Cable Address "FOSTER" Pittsburgh

A Man Technically Educated

and practically trained for structural fabrication plant management. Has a successful record and some money to invest. Prefer association with owners preparing for retirement.

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A reliable selling organization or manufacturer with extensive acquaintance in field of medium and heavy forging machinery with ample facilities to make and sell a new medium weight machine. Competition seems mostly eliminated and possibilities are unusual for expanding into large volume control of a heavy machine field, now depressed by competition.

ADDRESS BOX A-820, care *The Iron Age*, 811 Park Bldg., Pittsburgh, Pa.

Sales Organization Wanted

competent to place a minimum of $100,000.00 in iron castings business in a foundry with facilities for manufacturing castings ranging in weight from 5 pounds to 20,000 pounds. Foundry located within 75 miles of both New York and Philadelphia with open capacity for five times this amount of business. This is a real opportunity for the right party. Communicate with

BOX E-880
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MANUFACTURERS AGENT
Pittsburgh District

desires one additional account for industries in that territory. An exceptional opportunity for someone to secure representation through men having years of successful sales experience and acquaintance in territory, only a first class connection considered.

ADDRESS BOX E-872
care *The Iron Age*, 239 W. 39th St., New York.

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Calling on manufacturers of heavy machinery and the drop forging industry to sell heavy pressed, finish machined or rough machined forgings, die blocks, etc. Valuable sales contract open—New England, upper New York State, Philadelphia, Cleveland, Indianapolis, St. Louis and Pacific Coast.

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Well established, covering New York City and adjoining territory, wants additional high grade accounts. Commission basis.

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with broad practical experience and valuable clientele in Eastern Michigan territory.

OPEN FOR NEW LINE

of machinery, tools or factory equipment. Must have exceptional merit and good backing. Address with full particulars:—

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Soliciting inquiries from manufacturers interested in manufacturing metal specialty (patented) on royalty basis.

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Inquiries solicited from agents or brokers on small or intricate parts, by an old established Eastern Drop Forge outfit which will fully protect representatives and work out their problems rather than broadcast for tonnage work, without regard from where or whom. What have you got or had that has not been handled to your satisfaction?

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care *The Iron Age*, 239 W. 39th St., New York.

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(Qualified Experts in all lines)

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New York, Chicago, Boston, Atlanta

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Expert on metal products and metallurgical patents. Examiner U. S. Patent Office for 16 years.

JOHN BOYLE, Jr.—Patents
201 Ouray Building, Washington, D. C.

Different Every Week

The business offers submitted on this page are no indication of the full scope of this section.

IN OTHER ISSUES YOU WILL FIND:

For sale or lease, patent on power transmitting device.

For sale, plant and business making patented article.

For sale, complete rolling mill.

For sale, iron ore rights.

For sale, castings and blue prints of special machine.

For sale, controlling interest in boiler tank and structural shop.

For sale, half interest in plant making household metal articles.

For sale, plant sites.

To invest, $20,000 in sheet metal plant.

To buy, manufacturing plant.

Wanted, additional capital.

Wanted, a product to manufacture.

Wanted, to finance industrial concerns.

Wanted, to represent a manufacturer's product.

Wanted, plant and capital to develop agricultural invention.

Which prove that here is where executives of the metal working industries look, and will look for such a proposition as you have to offer.

Employment Exchange

HELP WANTED

PRODUCTION EXECUTIVE

for a large middle west steel fabricating plant with both jobbing and straight line production departments. Sound financially and enjoying a continuous healthy growth. The right man will be an outstanding plant executive at present employed, of proven ability, but who wants a broader future. He will be of middle age, with a wide experience in production problems, while a background of college and mechanical training will be helpful, the ability to organize, to hold men thru strength of character, to turn out work by careful planning are of vital importance. Your correspondence will be held strictly confidential. Please give an intimate detailed record of your training and experience.

P. W. MURPHY

800 Bulkley Bldg. Cleveland, Ohio

PROGRESSIVE BUSINESS EXECUTIVE with Mechanical Engineering training and experience as Assistant to President of large and rapidly growing Manufacturing Company in Western New York. Unusual opportunity and future for the right man. State fully experience, with whom, and for how long, also age, Nationality and salary expected. All replies will be considered in confidence. Address Box E-889, care *The Iron Age*, 239 W. 39th St., New York.

A MAN OF EXPERIENCE for machine shop foreman in a plant located in Ohio manufacturing Road Building and Construction Machinery, having their own foundry. Must be a first-class production man and well recommended. State age and salary wanted and give full information. Address Box E-892, care *The Iron Age*, 239 W. 39th St., New York.

SALESMEN, entire time or side line. Nationally and foreign known product, for factories, mill supply houses, farms; 40% commission. A-1 product, and steady repeat business. Established firm. Customers write in, we have the best product of its kind on the market. Address B. G., Box E-739, care *The Iron Age*, 239 W. 39th St., New York.

DRAFTSMEN—Experienced in Crane and Hoist design. NORTHERN ENGINEERING WORKS, Detroit, Michigan.

HELP WANTED

HIGH CLASS

positions and high class men mutually gravitate to this high class point of exchange of the metal working industries.

FOREMAN WANTED for SMALL SHOP making metal stampings, small drop forgings and manufacturing. Must be able to handle men, plan and lay out the work and get out production and be able to lay out and design dies for stamping and drop forging. Good opportunity for the right man. State experience. Location, Los Angeles, Calif. Box 184-D, care *The Iron Age*, 1507 Otis Bldg., Chicago, Ill.

SALESMAN—MATERIAL HANDLING EQUIPMENT IN NEW YORK AND NEW JERSEY TERRITORY. MUST BE THOROUGHLY QUALIFIED. SALARY AND BONUS. WRITE STATING EXPERIENCE AND QUALIFICATONS. ADDRESS BOX E-881, CARE *THE IRON AGE*, 239 W. 39TH ST., NEW YORK.

EXPERIENCED DROP FORGING MAN to take entire charge of Forge Plant. Preferably one with experience in forgings and heavy pressings for freight cars. Must be alert, progressive and familiar with modern methods. Give full particulars in replying. Address Box E-856, care *The Iron Age*, 239 W. 39th St., New York.

FIRST CLASS FOUNDRY FOREMAN for small Steel and Iron Foundry in Ontario employing about 60 men. Must be experienced in routing orders through shop and as first essential must be capable of handling men. Apply giving full particulars and salary expected to Address Box E-890, care *The Iron Age*, 239 W. 39th St., New York.

FOREMAN STRUCTURAL STEEL SHOP. FIRST CLASS MAN wanted, one who understands layout work and electric welding. Shop located in town of 15,000 in New York State. Apply with full particulars in first letter and state salary wanted. Address Box E-893, care *The Iron Age*, 239 W. 39th St., New York.

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Since 1919 $5,000 to $50,000 men in the metal trades have found our Service effective in making new connections. INDIVIDUAL. CONFIDENTIAL. Personally planned by Jacob Penn. Leading businessmen in and out of the metalworking industries know him and believe in him. Not an employment agency. **Jacob Penn., Inc., 11 Park Place, New York City.**

SALARIED POSITIONS
$2,500 to $25,000

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BRONZE—Phosphor

Phosphor Bronze Smelting Co., Phila.

BRONZE BAR—Cored and Solid

Frederickson Co., Saginaw, Mich.

BRUSHES—Industrial

Hanson-Van Winkle-Munning Co., Matawan, N. J.

BUCKETS—Clamshell

Blaw-Knox Co., Pittsburgh.
Broslius, Edgar E., Inc., Sharpsburg P. O., Ptgh.
Browning Crane Co., The, Cleveland.
Hayward Co., 50 Church St., N. Y. C.
Orton Crane & Shovel Co., Chicago.
Owen Bucket Co., Cleveland.
Williams, G. H., Co., Erie, Pa.

BUCKETS—Dragline

Harnischfeger Corp., Milwaukee.
Williams, G. H., Co., Erie, Pa.

BUCKETS—Electric Motor

Hayward Co., 50 Church St., N. Y. C.

BUCKETS—Elevator

Hendrick Mfg. Co., Carbondale, Pa.

BUCKETS—Orange Peel

Hayward Co., 50 Church St., N. Y. C.

BUCKETS—Single Line

Milwaukee (Wis.) Elec. Crane & Hoist Corp.

BUCKLES—Bale, Tie

Joliet (Ill.) Wrought Washer Co.

BUFFS

Divine Brothers Co., Utica, N. Y.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

BUILDINGS—Factory

Austin Co., The, Cleveland.
Blaw-Knox Co., Ptgh.
Fantus Factory Locating Service, Chicago.

BUILDINGS—Steel

American Bridge Co., 71 B'way, N. Y. C.
Austin Co., The, Cleveland.
Belmont Iron Works, Phila.
Blaw-Knox Co., Ptgh.
McClintic-Marshall Co., Ptgh.
Truscon Steel Co., Youngstown.

BULLDOZERS

Beatty Mch. & Mfg. Co., Hammond, Ind.

BUNDLERS—Scrap (Wire)

Vaughn Mchry. Co., Cuyahoga Falls, O.

BURNERS—Oil or Gas

Anthony Co., The L. I. City, N. Y.
Best, W. N., Corp., 295 5th Ave., N. Y. C.
Hauck Mfg. Co., 128 Tenth St., Bklyn., N. Y.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.

BURRS—Steel

Wrought Washer Mfg. Co., Milwaukee.

BUSHINGS—Brass and Bronze

Columbia Mch. Works & M. I., Co., 27 Chestnut St., Brooklyn, N. Y.
Erie (Pa.) Bronze Co.
Frederickson Co., Saginaw, Mich.
Harsch, John, Bronze & Fdry. Co., The, Cleveland, Ohio.

BUSHINGS—Oilless

Rhoades, R. W., Metalline Co., Inc., Long Island City, N. Y.

BUSHINGS—Phosphor Bronze

Phosphor Bronze Smelting Co., Phila.

CABLEWAYS AND TRAMWAYS—See Tramways

CABINETS—Steel

Angle Steel Stool Co., Plainwell, Mich.

CAR DUMPERS

Wellman-Seaver-Morgan Co., Cleveland.

CARBIDE

Air Reduction Sales Co., 342 Madison Ave., N. Y. C.
Union Carbide Sales Co., 30 E. 42nd St., N. Y. C.

CAR SPOTTER (Electric)

Caldwell, H. W., & Son Co., Chicago.

CARBURIZING—See Heat Treating

CARS—Dump

Atlas Car & Mfg. Co., Cleveland
Easton (Pa.) Car & Construction Co.

CARS—Industrial and Mining

Atlas Car & Mfg. Co., Cleve.
Chase Fdry. & Mfg. Co., Columbus, O.
Easton (Pa.) Car & Construction Co.

CASE HARDENING—See Heat Treating

CASTERS

Saginaw (Mich.) Stpg. & Tool Co.

CASTINGS—Acid or Heat Resisting

Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Harsch, John, Bronze & Fdry. Co., The, Cleveland, Ohio.
Huskins Mfg. Co., Detroit.
National Alloy Steel Co., Blawnox, Pa.

CASTINGS—Alloy Steel

Alloy Cast Steel Co., The, Marion, O.
Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Chicago (Ill.) Steel Foundry Co.
Milwaukee (Wisc.) Steel Fdry. Co.
National Alloy Steel Co., Blawnox, Pa.

CASTINGS—Aluminum

Bohn Aluminum & Brass Corp., Detroit.
Harsch, John, Bronze & Fdry. Co., The, Cleveland, Ohio.

CASTINGS—Brass, Bronze, Copper or Aluminum

Atlas Brass Fdry. Co., Columbus, Ohio.
Bethlehem (Pa.) Steel Co.
Bohn Aluminum & Brass Corp., Detroit.
Buffalo (N. Y.) Bronze Die Cast Corp.
Cadman, A. W., Mfg. Co., Ptgh.
Columbia Mch. Works & M. I., Co., 275 Chestnut St., Brooklyn, N. Y.
Douglas & Lomason Co., Detroit.
Enterprise Brass Works, Muskegon Heights, Mich.
Erie (Pa.) Bronze Co.
Gillette-Vibber Co., Inc., New London, Ct.
Harsch, John, Bronze & Fdry. Co., The, Cleveland, Ohio.
Lumen Bearing Co., Buffalo, N. Y.
Phosphor Bronze Smelting Co., Phila.
Spencer's, I. S., Sons, Inc., Guilford, Ct.
Turner & Seymour Mfg. Co., Torrington, Ct.
York (Pa.) Fdry. & Mch. Co.

CASTINGS—Die

Buffalo (N. Y.) Bronze Die Cast Corp.

CASTINGS—Electric Steel

Alloy Cast Steel Co., The, Marion, O.
American Rolling Mill Co., Middletown, Ohio.
American Steel Foundries, Chicago.
Chicago (Ill.) Steel Foundry Co.
Commercial Steel Casting Co., Marion, O.
Crucible Steel Casting Co., Cleve.
Fort Pitt Steel Casting Co., McKeesport, Pa.
Industrial Steel Casting Co., The, Toledo.
Maynard Elec. Steel Casting Co., Milw.
Milwaukee (Wisc.) Steel Fdry. Co.
Smith, Geo. H., Steel Casting Co., Milw.
Treadwell Engineering Co., Easton, Pa.

CASTINGS—Gray Iron

Bethlehem (Pa.) Steel Co.
Coldwell-Wilcox Co., Newburgh, N. Y.
Columbia Mch. Works & M. I. Co., 275 Chestnut St., Brooklyn, N. Y.
Connecticut Fdry. Co., The, Rocky Hill, Ct.
Eastern Fdry. Co., Boyertown, Pa.
Excelsior Tool & Mch. Co., E. St. Louis, Ill.
Eyster, Weiser Co., York, Pa.
Goslin-Birmingham Mfg. Co., Birmingham, Ala.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hill Clutch Mch. & Fdry. Co., Cleve., O.
Hyde Park (Pa.) Fdry. & Mach. Co.
Jones Iron Fdry. Co., Riverside Borough, Pa.
Kline Hardware Co., Allentown, Pa.
Manufacturers Fdry. Co., Waterbury, Ct.
Midvale Co., The, Nicetown, Phila., Pa.
Moloch Fdry. & Mch. Co., Kaukauna, Wis.
National Roll & Fdry. Co., Avonmore, Pa.
Newark (N. J.) Malleable Iron Wks., North Wales (Pa.) Mach. Co., Inc.
Nute, McGehee, Geary Co., Inc., Chambersburg, Pa.
Penn Foundry & Mfg. Co., Box 182, Reading, Pa.
Poole Engng. & Mch. Co., Balto., Md.
Royersford (Pa.) Fdry. & Mch. Co., Inc.
Sessions Foundry Co., The, Bristol, Ct.
Spencer's, I. S., Sons, Inc., Guilford, Ct.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Toledo (O.) Mch. & Tool Co.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Xenia (Ohio) Fdry. & Mch. Co.
York (Pa.) Fdry. & Mch. Co.

CASTINGS—Malleable

Flagg, Stanley G., & Co., Inc., Phila.
Link-Belt Co., 200 So. Belmont St., Indianapolis, Ind.
Malleable Iron Fittings Co., Branford, Ct.
Meeker Foundry Co., Newark, N. J.
Newark (N. J.) Malleable Iron Wks.
Northern Mal. Iron Co., St. Paul, Minn.
Peoria (Ill.) Malleable Castings Co.
Philadelphia (Pa.) Hardware & Malleable Iron Wks., Inc.
Pratt, William E., Mfg. Co., Chicago.
Richmond (Ind.) Malleable Castings Co.
Timken Steel & Tube Co., The, Canton, O.
Vermilion Mal. Iron Co., Hoopeston, Ill.

CASTINGS—Manganese Steel

Alloy Cast Steel Co., The, Marion, O.
Frog, Switch & Mfg. Co., The, Carlisle, Pa.

CASTINGS—Semi-Steel

Malleable Iron Fittings Co., Branford, Ct.

CASTINGS—Steel

Allegheny Steel Co., Brackenridge, Pa.
Alloy Cast Steel Co., The, Marion, O.
American Rolling Mill Co., Middletown, Ohio.
American Steel Foundries, Chicago.
Atlas Steel Casting Co., Buffalo, N. Y.
Bethlehem (Pa.) Steel Company
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Cann & Saul Steel Co., Phila.
Chicago (Ill.) Steel Foundry Co.
Cincinnati (O.) Steel Castings Co.
Commercial Steel Casting Co., Marion, O.
Crucible Steel Casting Co., Cleve.
Crucible Steel Castings Co., Lansdowne, Pa.
Duquesne Steel Fdry. Co., Pittsburgh, Pa.
Erie (Pa.) Forge Co.
Falk Corp., Milwaukee.
Fort Pitt Steel Casting Co., McKeesport, Pa.
Industrial Steel Casting Co., The, Toledo.
Malleable Iron Fittings Co., Branford, Ct.
Maynard Elec. Steel Castings Co., Milw.
Mesta Mch. Co., Ptgh.
Milwaukee (Wisc.) Steel Fdry. Co.
Scullin Steel Co., St. Louis, Mo.
Smith, Geo. H., Steel Casting Co., Milw.
Strong Steel Foundry Co., Buffalo, N. Y.
Union Steel Casting Co., Pittsburgh.
Union Switch & Signal Co., Swissvale, Pa.

CEMENT—Insulating

Armstrong Cork & Insulation Co., Lancaster, Pa.

CEMENT—Leather Belting

Graton & Knight Co., Worcester, Mass.

CEMENT—Quick Setting, Acid Proof and Insulator

Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.

CEMENT—Porcelain

Technical Products Co., Ptgh.

CEMENT—Refractory

Carborundum Co., The, Perth Amboy, N. J.
Harbison-Walker Refractories Co., Ptgh.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Technical Products Co., Ptgh.

CEMENT—Silica and Chrome

General Refractories Co., Phila.
Harbison-Walker Refractories Co., Ptgh.

CEMENT ROOFING TILE

American Cement Tile Mfg. Co., 803 Oliver Bldg., Ptgh.

CENTERING MACHINES

Whiton, D. E., Mach. Co., New London, Ct.

CENTERS—Index

Simmons Mch. Tool Corp., Albany, N. Y.

CENTERS—Lathe and Grinder

Haynes Stellite Co., 30 East 42nd St., N. Y. C.

CHAINS—Cable

Morton, Thomas, 245 Centre St., N. Y. C.

CHAINS—Conveyor and Elevator

Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jones & Laughlin Steel Corp., Ptgh.
Link-Belt Co., Chicago

CHAINS—Crane & Hoist

Bradlee & Co., Inc., Philadelphia.

CHAINS—Dredge

Bradlee & Co., Inc., Philadelphia.

CHAINS—Power Transmission

Boston Gear Works Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Co., Chicago
Morse Chain Co., Ithaca, N. Y.
Whitney Mfg. Co., Hartford, Conn.

CHAINS—Rocker Joint

Morse Chain Co., Ithaca, N. Y.

CHAINS—Sling

Bradlee & Co., Inc., Phila.

CHAINS—Sash

Morton, Thos., 245 Centre St., N. Y. C.

CHAIRS—Adjustable

Vitek Mfg. Co., Omaha, Neb.

CHANNELS—See Angles, Beams, Channels and Tees

CHAPLETS

Erdle Perforating Co., Rochester, N. Y.

CHARGING MACHINES—Cupola

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CHARGING MACHINES—Manipulators

Wellman-Seaver-Morgan Co., Cleveland.

CHECKS—Metal

Noble & Westbrook Mfg. Co., Hartford, Ct.

CHEMICALS—Industrial

Vanadium Corp. of America, 120 B'way, N. Y. C.

CHROMIUM METAL
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.

CHUCKING MACHINES—Automatic
Baird Mch. Co., Bridgeport, Ct.
Cleveland (O.) Automatic Mch. Co., The.
New Britain-Gridley Mch. Co., The, New Britain, Ct.

CHUCKING MACHINES — Multiple Spindle
Baird Mch. Co., Bridgeport, Ct.
National Acme Co., The, Cleve.

CHUCKS—Air Operated
Logansport (Ind.) Mch. Co.
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS—Drill
Cleveland (O.) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

CHUCKS—Lathe
Hoggson & Pettis Mfg. Co., New Haven, Ct.
Union Mfg. Co., New Britain, Conn.
Whiton, D. E., Mch. Co., New London, Ct.

CIRCLES—Phosphor Bronze
Phosphor Bronze Smelting Co., Phila.

CLAMPS—Safety for Handling Boiler Plate
Never Slip Safety Clamp Co., 51 East 42nd St., N. Y. C.

CLAY GUN
Bailey, Wm. M., Co., Ptgh.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Ford, J. B., Co., Wyandotte, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.
Oakite Prod., Inc., 22 Thames St., N.Y.C.

CLEANING MATERIALS—Glass
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.

CLOTHING—Asbestos and Fireproof
Safety Equipment Service Co., Cleveland, Ohio.

CLUTCHES—Friction
Caldwell, W. E., Co., 260 Brandels Street, Louisville, Ky.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Johnson, Carlyle, Mch. Co., Manchester, Ct.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Schultz, A. L., & Son, Chicago.
Twin Disc Clutch Co., Racine, Wis.

CLUTCHES—Magnetic
Cutler-Hammer, Inc., Milwaukee.
Magnetic Mfg. Co., Milwaukee.

COAL
Cleveland (O.) Cliffs Iron Co.
Hanna, M. A., Co., The, Cleveland.
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., N. Y. C.
Shenango-Penn Mold Co., Ptgh.

COAL, ORE AND ASH HANDLING MACHINERY
Alliance (O.) Machine Co.
Bartlett, C. O. & Snow Co., Cleve.
Hayward Co., The, 50 Church St., N.Y.C.
Link-Belt Co., Chicago
Wellman-Seaver-Morgan Co., Cleveland.

COILING MACHINES—Metallic, Hose, Speedometer, Casing, Resistance Coils, Wire Spirals, Etc.
Sleeper & Hartley, Inc., Worcester, Mass.

COILS—Armature and Field
Columbia Mch. Works & M. I., Co., 275 Chestnut St., Bklyn.

COILS—Pipe
Cornell & Underhill, Spring & Greenwich Sts., N. Y. C.

COKE—Metallurgical
Bethlehem (Pa.) Steel Co.
Cleveland (O.) Cliffs Iron Co.
Hillman Coal & Coke Co., Ptgh.
Marshall, F. W., & Co., Phila.
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., N. Y. C.
Shenango-Penn Mold Co., Ptgh.
Walter-Wallingford & Co., Cincinnati

COKE OVEN MACHINERY
Alliance (O.) Machine Co.
Atlas Car & Mfg. Co., Cleve.
Wellman-Seaver-Morgan Co., Cleveland.

COLLARS—Spacing for Milling Cutters
Detroit (Mich.) Stamping Co.

COLLETS
Rivett Lathe & Grinder Corp., Boston

COMPOSITIONS—Buffing & Polishing
Hanson-Van Winkle-Munning Co., Matawan, N. J.

COMPRESSORS—Air
Allis-Chalmers Mfg. Co., Milwaukee.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
De Laval Steam Turbine Co., Trenton, N. J.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Penna Pump & Compressor Co., Easton, Pa.
Spencer Turbine Co., Hartford, Conn.
Sullivan Mchry. Co., Chicago.
Westinghouse Traction Brake Co., Wilmerding, Pa.

COMPRESSORS—Gas
Bury Compressor Co. Erie, Pa.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Penna Pump & Compressor Co., Easton, Pa.

CONCRETE CONSTRUCTION
Austin Co., The, Cleveland.

CONCRETE MACHINERY
Ransohoff, N., Inc., Cinn., Ohio.

CONCRETE REINFORCEMENT
American Steel & Wire Co., Chicago.

CONCRETE ROOFING TILE
American Cement Tile Mfg. Co., 803 Oliver Bldg., Ptgh.

CONDENSERS—Surface and Jet
Dean Bros. Co., Indianapolis, Ind.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
U. S. Pipe & Fdry. Co., Burlington, N. J.

CONDUCTOR PIPE
Newport (Ky.) Rolling Mill Co.

CONNECTING RODS
Leard, William Co., New Brighton, Pa.

CONTRACTORS—General
Austin Co., The, Cleveland.

CONTRACTORS' SUPPLIES — Secondhand
Albert & Davidson Pipe Corp., 2nd Ave., 50-51st St., Bklyn.
Albert Pipe Supply Co., Inc., Berry & N. 13th St., Bklyn.

CONTROLLERS—Crane
Cutler-Hammer, Inc., Milwaukee.

CONTROLLERS—Electric
Cutler-Hammer, Inc., Milwaukee.

CONTROLLERS—Electric Motor
Clark Controller Co., The, Cleveland, O.
Cutler-Hammer, Inc., Milwaukee.
Electric Controller & Mfg. Co., Cleve.

CONTROLLERS—Temperature
Bristol Co., Waterbury, Ct.
Brown Instrument Co., The, Philadelphia.
Taylor Instrument Companies, Rochester, N. Y.
Wilson-Maeulen Co., Inc., 738 E. 143rd St., N. Y. C.

CONTROLLERS—Valve, Electrically Operated
Cutler-Hammer, Inc., Milwaukee.

CONVEYING AND ELEVATING MACHINERY
Bartlett, C. O. & Snow Co., Cleve.
Link-Belt Co., Chicago
Mathews Conveyer Co., Ellwood City, Pa.
Palmer-Bee Co., Detroit.
Portable Machinery Co., Clifton, N. J.

CONVEYORS—Gravity
Mathews Conveyer Co., Ellwood City, Pa.

CONVEYORS—Portable
Portable Machinery Co., Clifton, N. J.

COOLING DEVICES—Furnace
Blaw-Knox Co., Ptgh.

COPING MACHINES
Cleveland (O.) Punch & Shear Wks. Co.
Pels, Henry, & Co., 90 West St., N. Y. C.

CORE MAKING MACHINES
Amer. Fdry. Equip Co., Mishawaka, Ind.

CORUNDUM WHEELS—See Grinding Wheels

COTTERS AND KEYS—Spring
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spring Co., Pontiac, Mich.
Smith, F. P., & Co., Sharon Hills, Pa.
Western Wire Products Co., St. Louis.

COUNTERBORES
Cleveland (O.) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

COUNTERS—Production
Hart, R. E., Mfg. Co., Battle Creek, Mich.
Veeder-Root, Inc., Hartford, Ct.

COUNTING MACHINES
Hart, R. E., Mfg. Co., Battle Creek, Mich.
Veeder-Root, Inc., Hartford, Ct.

COUPLINGS—Air Hose
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Cleveland (O.) Pneumatic Tool Co., The

COUPLINGS—Cut-off, Friction
Johnson, Carlyle, Mch. Co., Manchester, Ct.

COUPLINGS—Flexible
Ajax Flexible Coupling Co., Westfield, N. Y.
Boston Gear Works Sales Co., Norfolk Downs, Mass.
Clark Controller Co., The, Cleveland, O.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Palmer-Bee Co., Detroit.
Poole Engng. & Mch. Co., Balto., Md.

COUPLINGS—Friction Clutch
Caldwell, W. E., Co., 260 Brandels St., Louisville, Ky.
Conway Clutch Co., 1948 West 6th St., Cinc.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Johnson, Carlyle, Mch. Co., Manchester, Ct.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Rd., Chicago.

COUPLINGS—Shaft
Falk Corp., Milwaukee.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Rd., Chicago.
Tomkins-Johnson Co., Jackson, Mich.

CRANES—Crawling Tractor
Browning Crane Co., The, Cleveland.
Conkey, H. D., & Co., 36 So. Jefferson St., Mendota, Ill.
Harnischfeger Corp., Milwaukee.
Link-Belt Co., Chicago
Orton Crane & Shovel Co., Chicago.

CRANES — Electric, Industrial Truck Mounted
Baker-Raulang Co., Cleveland.
Crescent Truck Co., Lebanon, Pa.

CRANES—Electric Traveling
Alliance (O.) Machine Co.
American Crane Co., Inc., The, Friendship, N. Y.
Bedford (Ind.) Foundry & Machine Co.
Box Crane & Hoist Corp., Phila.
Cleveland Crane & Engng., Wickliffe, O.
Conkey, H. D., & Co., 36 So. Jefferson St., Mendota, Ill.
Euclid (O.) Crane & Hoist Co.
Harnischfeger Corp., Milwaukee.
Manning, Maxwell & Moore, Inc. (Shaw Crane Wks.), 100 E. 42nd St., N.Y.C.
Maris Brothers, Inc., Phila.
Milwaukee (Wis.) Elec. Crane & Hoist Corp.
Morgan Engineering Co., Alliance, O.
Northern Engng. Wks., 212 Chene St., Detroit.
Payne, N. B., & Co., 25 Church St., N.Y.C.
Roeper Crane & Hoist Wks., Inc., Reading, Pa.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., Harvey, Ill.
Yale & Towne Mfg. Co., Stamford, Ct.

CRANES—Gantry
American Crane Co., Inc., The, Friendship, N. Y.
Cleveland Crane & Engng., Wickliffe, O.
Morgan Engineering Co., Alliance, O.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Wellman-Seaver-Morgan Co., Cleveland.
Whiting Corp., Harvey, Ill.

CRANES—Hand Power
Alliance (O.) Machine Co.
Armington Engineering Co., Euclid, O.
Bedford (Ind.) Foundry & Machine Co.
Box Crane & Hoist Corp., Phila.
Cleveland Crane & Engng., Wickliffe, O.
Maris Brothers, Inc., Phila.
Milwaukee (Wis.) Elec. Crane & Hoist Corp.
Payne, N. B., & Co., 25 Church St., N.Y.C.
Wright Mfg. Co., Bridgeport, Ct.
Whiting Corp., Harvey, Ill.

CRANES—Jib
Armington Engng. Co., Euclid, Ohio.
Box Crane & Hoist Corp., Phila.
Northern Engng. Wks., 212 Chene St., Detroit.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., Harvey, Ill.
Yale & Towne Mfg. Co., Stamford, Ct.

CRANES—Locomotive
Browning Crane Co., The, Cleveland.
Harnischfeger Corp., Milwaukee.
King, Phillip T., 50 Church St., N. Y. C.
Link-Belt Co., Chicago
Manning, Maxwell & Moore, Inc. (Shaw Crane Wks.), 100 E. 42nd St., N.Y.C.
Ohio Locomotive Crane Co., Bucyrus, O.
Orton Crane & Shovel Co., Chicago.

CRANES—Monorail
American MonoRail Co., The, Cleveland.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CRANES—Motor Truck
Browning Crane Co., The, Cleveland.

CRANES—Portable
Canton (O.) Fdry. & Machine Co.

CRANES—Portable, Electric
Automatic Transportation Co., Inc., Buffalo, N. Y.

CRANES—Wall
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CRANK SHAFTS
Leard, William Co., New Brighton, Pa.
Union Switch & Signal Co., Swissvale, Pa.

CRIMPING MACHINES
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Streine Tool & Mfg. Co., New Bremen, O.

CRUCIBLES—Metallurgical
McCullough-Dalzell Crucible Co., Ptgh.
Ross-Taconv Crucible Co., Phila.

CRUSHERS—Coal
American Pulverizer Co., St. Louis, Mo.
Bartlett, C. O. & Snow Co., Cleve.

CRUSHERS—Steel Turning
American Crusher & Machinery Corp 853 B'dway, N. Y. C.
American Pulverizer Co., St. Louis, Mo.

CRUSHERS—Stone
Morgan Engineering Co., Alliance, O.

CULVERTS
Newport (Ky.) Rolling Mill Co.

CUPOLAS—Foundry
Whiting Corp., Harvey, Ill.
Northern Engng. Wks., 212 Chene St., Detroit.

CUTTERS—Milling
Brown & Sharpe Mfg. Co., Prov., R. I.
Cleveland (O.) Twist Drill Co.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTING COMPOUNDS
Oakite Prod., Inc., 22 Thames St., N.Y.C.

CUTTING OFF MACHINES—Cold Saw
Espen-Lucas Mch. Wks., Philadelphia.
Hurlbut Rogers Mchry. Co., The, Nashua, N. H.

CUTTING-OFF MACHINES — Pipe or Tubing
Bardons & Oliver, Cleve.
Bignall & Keeler Mach. Work, Edwardsville, Ill.
Etna Machine Co., The, Toledo, O.
Hurlbut Rogers Mchry. Co., The, Nashua, N. H.
Landis Mch. Co., Inc., Waynesboro, Pa.

CUTTING AND WELDING APPARATUS —Oxy-Acetylene—See Welding and Cutting Machines and Equipment—Oxy-Acetylene

DERRICKS
Hayward Co., The, 50 Church St., N. Y. C.
Mallory Machry. Corp., Baltimore.

DESKS—Steel (Factory)
Angle Steel Stool Co., Plainwell, Mich

DIAMOND TOOLS
Bausch & Lomb Optical Co., Rochester, N. Y.
Dickinson, Thos. L., 34 Gold St., N. Y. C.

DIE BLOCKS
Bethlehem (Pa.) Steel Co.
Heppenstall Forge & Knife Co., Ptgh.
Wetherell Bros. Co., Cambridge, 39, Mass.

DIE ROLLING—Continuous
Witherow Steel Corp., Pittsburgh.

DIE SINKING MACHINES
Gorton, George, Machine Co., Racine, Wis.

DIE SINKING MACHINES—Automatic
Keller Mechanical Engng. Corp., 78 Washington St., Brooklyn, N. Y.

DIES—Embossing and Stamping
Hoggson & Pettis Mfg. Co., New Haven, Ct.
Keller Mechanical Engng. Corp., 78 Washington St., Brooklyn, N. Y.
Schwerdtle Stamp Co., Bridgeport, Ct.

DIES—Gripping and Heading
Marchant, Geo. F., Co., Chicago.

DIES—Pipe Threading
Bignall & Keeler Mch. Wks., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Ct.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.

DIES—Screw and Thread Cutting
Curtis & Curtis Co., Bridgeport, Ct.
Eastern Mach. Screw Corp., New Haven, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
National Acme Co., The, Cleve.

DIES—Self-Opening Adjustable
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Eastern Mach. Screw Corp., New Haven, Ct.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mach. & Tool Co., 951 Porter St., Detroit.
National Acme Co., The, Cleve.

DIES—Sheet Metal Working
Adriance Machine Wks., Inc., 82 Richards St., Bkyn., N. Y.
Beatty Mch. & Mfg. Co., Hammond, Ind.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.

Cleveland (O.) Punch & Shear Wks. Co.
Ferracute Machine Co., Bridgeton, N. J.
New England Pressed Steel Co., 1 Washington Ave., Natick, Mass.
Niagara Mch. & Tool Wks., Buffalo, N. Y.
Richards, I. P., Co., Providence, R. I.
Toledo (O.) Mach. & Tool Co.
V & O Press Co., Hudson, N. Y.
Worcester (Mass.) Stamped Metal Co.
Zeh & Hahnemann Co., Newark, N. J.

DIES—Steel Letters and Stamps
Noble & Westbrook Mfg. Co., Hartford, Ct.

DISCS—Abrasive
Gardner Machine Co., Beloit, Wis.

DOLOMITE
Baker, J. E., Co., York, Pa.

DOORS—Steel (Copper Bearing)
Truscon Steel Co., Youngstown.

DOORS AND SHUTTERS—Fireproof
Cornell Iron Works, Inc., 71 Marion St., Long Island City, N. Y.
Kinnear Mfg. Co., 817-67 Field Ave., Columbus, Ohio.

DOLOMITE BACK WALL MACHINES
Blaw-Knox Co., Ptgh.

DOORS AND SHUTTERS—Steel or Wood Rolling
Cornell Iron Works, Inc., 71 Marion St., Long Island City, N. Y.
Kinnear Mfg. Co., 817-67 Field Ave., Columbus, Ohio.

DRAWBENCHES
Aetna-Standard Eng. Co., Youngstown, O.

DRAWN WORK—Metal—See Stampings or Drawings—Metal

DRILL HEADS—Multiple
Baker Bros., Inc., Toledo, O.

DRILLING MACHINES—Automatic
Barnes Drill Co., Inc., Rockford, Ill.

DRILLING MACHINES—Bench
Avey Drilling Mch. Co., Cincinnati, O.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.

DRILLING MACHINES—Heavy Duty
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Inc., Rockford, Ill.

DRILLING MACHINES—Horizontal
Baker Bros., Inc., Toledo, O.
Barnes, W. F. & John, Co., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence, R. I.

DRILLING MACHINES—Multiple Spindle
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Inc., Rockford, Ill.
Defiance (O.) Machine Works
Langelier Mfg. Co., Providence, R. I.
Thomas Spacing Mch. Co., Ptgh., Pa.

DRILLING MACHINES—Multiple, Spindle Adjustable
National Automatic Tool Co., Richmond, Ind.

DRILLING MACHINES—Multiple, Spindle Horizontal
National Automatic Tool Co., Richmond, Ind.

DRILLING MACHINES—Multiple Spindle Vertical
Avey Drilling Mch. Co., Cincinnati, O.
National Automatic Tool Co., Richmond, Ind.

DRILLING MACHINES—Portable Electric
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Independent Pneumatic Tool Co., Chicago.
Nicholson Mfg. Co., Towson, Md.
Standard Electrical Tool Co., The, Cincl.

DRILLING MACHINES—Portable Pneumatic
Cleveland (O.) Pneumatic Tool Co., The.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Rotor Air Tool Co., The, Cleveland.

DRILLING MACHINES—Radial
American Tool Works Co., Cincl.
Cincinnati (O.) Bickford Tool Co.
Cleveland (O.) Punch & Shear Wks. Co.
Ryerson, Jos. T. & Son, Inc., Chicago.
Thomas Spacing Mch. Co., Ptgh., Pa.

DRILLING MACHINES—Rock
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.

DRILLING MACHINES—Sensitive
Avey Drilling Mch. Co., Cincinnati, O.
Langelier Mfg. Co., Providence, R. I.
Leland-Gifford Co., Worcester, Mass.
Taylor & Fenn Co., Hartford, Ct.

DRILLING MACHINES—Vertical
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Inc., Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo (N. Y.) Forge Co., 492 B'way
Champion Blower & Forge Co., Lancaster, Pa.
Cincinnati (O.) Bickford Tool Co.
Defiance (O.) Machine Works
Ryerson, Jos. T., & Son, Inc., Chicago.

DRIVES—Gear
Mesta Mch. Co., Ptgh.

DROP FORGINGS—See Forgings—Drop, Iron or Steel

DROP HAMMERS—See Hammers—Drop

DROP PRESSES—See Presses—Drop

DRYERS FOR ALL MATERIAL
Bartlett, C. O. & Snow Co., Cleve.
Drying Systems, Inc., Chicago, Ill.
Duff Patents Co., Inc., Ptgh.

DUST COLLECTORS
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.
Research Corp., 25 West 43rd St., N. Y. C.
Sly, W. W., Mfg. Co., Cleveland, O.
Whiting Corp., Harvey, Ill.

EAVE TROUGH—See Gutters

ELECTRIC LIGHTING
Cooper Hewitt Electric Co., Hoboken, N. J.

ELECTRIC HEATING ELEMENTS
Globar Corp., Niagara Falls, N. Y.

ELECTRIC WELDING—See Welding—Electric

ELECTRICAL MACHINERY — Second Hand
Land, L. J., 207 Centre St., N. Y. C.
Sachsenmaier, Geo., Co., Phila., Pa.

ELECTRICAL WIRES
American Steel & Wire Co., Chicago.

ELEVATORS—Portable
Lewis-Shepard Co., 122 Walnut St., Watertown Station, Boston.

EMERY WHEELS—See Grinding Wheels

ENAMELING MCHS.—Magnetic Wire
Sleeper & Hartley, Inc., Worcester, Mass.

ENGINEERS—Consulting
Brassert, H. A., & Co., Chicago.
Freyn Engineering Co., Chicago.
McKee, Arthur G., & Co., Cleve.
Perin & Marshall, 11 West 42nd St., N. Y. C.

ENGINEERS—Fabricating
Pittsburgh (Pa.) Producers Supply Co.

ENGINEERS—Foundry
Austin Co., The, Cleveland.

ENGINEERS—Industrial
Kennedy, Samuel H., Co., Tunnel Hill, Georgia.
Llewelyn, Thomas J., & Co., Ptgh.
Stone, Francis & Hart, 165 Broadway, N. Y. C.

ENGINEERS—Metallurgical
Gathmann Engineering Co., Baltimore, Md.

ENGINEERS—Welding
Pittsburgh (Pa.) Producers Supply Co.

ENGINEERS AND CONTRACTORS
Austin Co., The, Cleveland.
Criswell, James, Co., Pittsburgh, Pa.
Kennedy, Julian, Ptgh.
Kennedy, Samuel H., Co., Tunnel Hill, Georgia.
Laughlin, Alex., & Co., Ptgh.
McKee, Arthur G., & Co., Cleve.
Nalsmith, Geo., & Son, Ptgh.
Pennsylvania Engng. Wks., New Castle, Pa.
Stevens, Arthur L., Corp., Chicago.
Sutton Engng. Co., Ptgh.
Swindell, W., & Bros., Box 1753, Ptgh.

ENGINES—Blowing
Mackintosh-Hemphill Co., Ptgh.

ENGINES—Gas
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.

ENGINES—Oil
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.

ENGINES—Steam
Dake Engine Co., Grand Haven, Mich.
Troy (Pa.) Engine & Mch. Co.

ENGRAVING MACHINES
Gorton, George, Machine Co., Racine, Wis.

EYELET MACHINES
Manville, E. J., Mch. Co., Waterbury, Ct.

EYELETS
Platt Bros. & Co., The, Waterbury, Ct.

FACING HEADS
Mummert-Dixon Co., Hanover, Pa.

FACING MACHINES—Structural
Thomas Spacing Mch. Co., Ptgh., Pa.

FACTORY CONSTRUCTION
Austin Co., The, Cleveland.

FELTS—Wool Mechanical
Booth Felt Co., Inc., The, 477-478 19th St., Bkyn., N. Y.

FENCES—Woven Wire
American Steel & Wire Co., Chicago.
Page Steel & Wire Co., Bridgeport, Ct.

FENCING—Wire
Bethlehem (Pa.) Steel Co.
Jones & Laughlin Steel Corp., Ptgh.

FERRO ALLOYS—Chromium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.
Lavino, E. J., & Co., Phila.
Pittsburgh Metallurgical Co., Niagara Falls, N. Y.
Samuel, Frank, & Co., Phila.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FERRO ALLOYS—Manganese
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.
Lavino, E. J., & Co., Phila.
Pittsburgh Metallurgical Co., Niagara Falls, N. Y.
Rogers Brown & Crocker Bros., Inc., 21 East 40th St., N. Y. C.
Samuel, Frank, & Co., Phila.

FERRO ALLOYS—Molybdenum
Lavino, E. J., & Co., Phila.

FERRO ALLOYS—Silico Manganese
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FERRO ALLOYS—Silicon
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.
Lavino, E. J., & Co., Phila.
Pittsburgh Metallurgical Co., Niagara Falls, N. Y.
Rogers Brown & Crocker Bros., Inc., 21 East 40th St., N. Y. C.
Samuel, Frank, & Co., Phila.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FERRO ALLOYS—Silicon Aluminum
Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

FERRO ALLOYS—Spiegeleisen
Leavitt, C. W., & Co., 30 Church St., N. Y. C.
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., N. Y. C.
St. Joseph Lead Co., 250 Park Ave., N. Y. C.

FERRO ALLOYS—Titanium
Metal & Thermit Corp., 120 B'way, N. Y. C.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERRO ALLOYS—Tungsten
Lavino, E. J., & Co., Phila.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FERRO ALLOYS—Vanadium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.
Lavino, E. J., & Co., Phila.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FILES AND RASPS
American Swiss File & Tool Co., Elizabeth, N. J.
Athins, E. C., & Co., Indianapolis, Ind.
Heller Bros. Co., Newark, N. J.

FILES—Precision
American Swiss File & Tool Co., Elizabeth, N. J.

FILTER CLOTH—Asbestos
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

FILTERS—Pressure or Gravity
Scaife, Wm. B., & Sons Co., Ptgh.

FIRE CLAY
General Refractories Co., Phila.

FITTINGS—Brass, Pipe and Tube
Commonwealth Brass Corp., Detroit.

FITTINGS—Hydraulic
Watson-Stillman Co., 71 West St., N. Y. C.

FITTINGS—Steam and Gas Pipe
Cornell & Underhill, Spring & Greenwich Sts., N. Y. C.

FITTINGS—Tank
Flagg, Stanley G., & Co., Inc., Phila.

FLANGES—Forged Steel
Cann & Saul Steel Co., Phila.
Taylor Forge & Pipe Wks., Chicago.

FLANGES—Iron or Steel
Philadelphia (Pa.) Steel & Iron Co.

FLANGES—Stainless Steel
Baldt Anchor Chain & Forge Corp., Chester, Pa.

FLANGES—Upset Forged
Amer. Forge Co., 2621 S. Hoyne Ave., Chicago.

FLASKS—Foundry
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Sterling Wheelbarrow Co., Milwaukee.

FLEXIBLE SHAFT EQUIPMENT
Chicago (Ill.) Flexible Shaft Company.
Fischer, Chas., Spring Co., 242 Kent Ave., Brooklyn, N. Y.
Keller Mechanical Engng. Corp., 76 Washington St., Brooklyn, N. Y.

FLOOR ARMORING
Blaw-Knox Co., Ptgh.
Hendrick Mfg. Co., Carbondale, Pa.

FLOORING—Built-Up Wood Blocks
Carter Bloxonend Flooring Co., Kansas City, Mo.

FLOORING—Creosoted Wood
Jennison-Wright Co., Toledo

FLOORING—Metallic Ventilating
Irving Iron Works Co., L. I. City, N. Y.

FLOORING—Monolithic
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

FLOORING—Steel
Blaw-Knox Co., Ptgh.

FLUORSPAR
Lavino, E. J., & Co., Phila.
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., N. Y. C.

FORGES—Rivet
Buffalo (N. Y.) Forge Co., 492 B'way
Champion Blower & Forge Co., Lancaster, Pa.
Hauck Mfg. Co., 138 Tenth St., Bkyn., N. Y.

FORGING MACHINES
Acme Machinery Co., Cleve.
National Machinery Co., Tiffin, O.

FORGINGS—Alloy Steel
Amer. Forge Co., 2621 S. Hoyne Ave., Chicago.
Bethlehem (Pa.) Steel Co.
Cann & Saul Steel Co., Phila.
Erie (Pa.) Forge Co.
Heppenstall Forge & Knife Co., Ptgh.
Machinery Forging Co., The, Cleveland, O.
National Forge & Ordnance Co., Irvine, Pa.
Smith-Armstrong Forge, Inc., Cleveland.
Vulcan Steam Forging Co., Buffalo, N. Y.

FORGINGS—Brass, Bronze or Copper
American Brass Co., Waterbury, Ct.
Bossert Corp., The, Utica, N. Y.
Commonwealth Brass Corp., Detroit.
National Lock Washer Co., Newark, N. J.

FORGINGS—Coin Pressed
Rockford (Ill.) Drop Forge Co.

FORGINGS—Drop, Iron or Steel
Atlas Drop Forge Co., Lansing, Mich.
Baldt Anchor Chain & Forge Corp., Chester, Pa.
Bethlehem (Pa.) Steel Co.
Cann & Saul Steel Co., Phila.
Canton (O.) Forge & Axle Co.
Champion Machine & Forging Co., Cleve.
Clapp, E. D., Mfg. Co., The, 86 S. Division St., Auburn, N. Y.
Cleveland (O.) Hardware Co., The
Davenport (Iowa) Locomotive & Mfg. Corp.
Drop Forging Co. of New York, Jersey City, N. J.
Indianapolis (Ind.) Drop Forging Co.
Keystone Forging Co., Northumberland, Pa.
Kilborn & Bishop Co., The, New Haven, Conn.
Laclede Steel Co., St. Louis, Mo.
Leard, William Co., New Brighton, Pa.
Lloyd Forge Co., Annville, Pa.
Milwaukee (Wis.) Forge & Mch. Co.
National Lock Washer Co., Newark, N. J.
Paul, W. P., Co., Phila.
Philadelphia (Pa.) Steel & Iron Co.
Pittsburgh Forgings Co., Coraopolis, Pa.
Queen City Forging Co., Cincl, O.
Rhode Island Tool Co., Providence, R. I.
Rockford (Ill.) Drop Forge Co.
Schollhorn, Wm. Co., The, New Haven, Conn.
Storms Drop Forging Co., East Springfield, Mass.
Union Switch & Signal Co., Swissvale, Pa.
U. S. Body & Forging Co., Inc., Buffalo, N. Y.
Wilcox, D., Mfg. Co., Mechanicsburg, Pa.
Williams, J. H., & Co., Buffalo, N. Y.

FORGINGS—Flat Die
Smith-Armstrong Forge, Inc., Cleveland.

FORGINGS—Hammered
Columbia Mch. Works & M. I., Co., 271 Chestnut St., Bkyn, N. Y.
Davenport (Iowa) Locomotive & Mfg. Corp.
Erie (Pa.) Forge Co.
Helmick Fdry. Mach. Co., Fairmont, W. Va.
Machinery Forging Co., The, Cleveland, O.
Smith-Armstrong Forge, Inc., Cleveland.
Vulcan Steam Forging Co., Buffalo, N. Y.

FORGINGS—Hollow
American Forge Co., 2621 S. Hoyne Ave., Chicago.
Erie (Pa.) Forge Co.
National Forge & Ordnance Co., Irvine, Pa.

FORGINGS — Hydraulic Press, Iron or Steel
Atlas Drop Forge Co., Lansing, Mich.
Bethlehem (Pa.) Steel Co.
Champion Mach. & Forging Co., Cleve.
Erie (Pa.) Forge Co.
Mesta Mch. Co., Ptgh.
Midvale Co., The, Nicetown, Phila., Pa.

FORGINGS—Manganese Steel
Manganese Steel Forge Co., Phila.

FORGINGS—Stainless Steel
Baldt Anchor Chain & Forge Corp., Chester, Pa.
Kilborn & Bishop Co., The, New Haven, Conn.

FORGINGS—Upset
Amer. Forge Co., 2621 S. Hoyne Ave., Chicago.
Canton (O.) Forge & Axle Co.
Lake Erie Bolt & Nut Co., The, Cleve.
Neely Nut & Bolt Co., Pitts.
Rockford (Ill.) Drop Forge Co.

FORMING AND COILING MACHINE
Yoder Co., The, Cleveland.

FOUNDRY EQUIPMENT AND SUPPLIES
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Clifton Mchy. Co., Cincinnati.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
National Engineering Company, Chicago.
Sly, W. W., Mfg. Co., Cleveland, O.
Whiting Corp., Harvey, Ill.

FROGS AND SWITCHES—Railway
Bethlehem (Pa.) Steel Co.
Sweet's Steel Co., Williamsport, Pa.

FURNACE INSULATION
Armstrong Cork & Insulation Co., Lancaster, Pa.

FURNACES—Billet or Ingot Heating
Hagan, Geo. J., Co., Pittsburgh.
Holcroft & Co., Detroit.
Naismith, Geo., & Son, Ptgh.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.
Swindell, W., & Bros., Box 1753, Ptgh.

FURNACES—Blast
Freyn Engineering Co., Chicago.
McKee, Arthur G., & Co., Cleve.
Pennsylvania Engng. Wks., New Castle Pa.
Pollock, Wm. B., Co., Youngstown, O.

FURNACES—Crucible
Swindell, W. & Bros., Box 1753, Ptgh.

FURNACES—Electric Steel Melting
Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., 71 B'way, N. Y. C.
Detroit (Mich.) Electric Furnace Co.
Greene Electric Furnace Co., Seattle, Wash.
Pittsburgh (Pa.) Electric Furnace Corp.
Swindell, W., & Bros., Box 1753, Ptgh.

FURNACES—Enameling
Carborundum Co., The, Perth Amboy, N. J.

FURNACES—Forging
Best, W. N., Corp., 295 5th Ave., N.Y.C.
Chicago (Ill.) Flexible Shaft Company.
Holcroft & Co., Detroit.
Naismith, Geo., & Son, Ptgh.
Rockwell, W. S., Co., 50 Church St., N.Y.C.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.
Swindell, W. & Bros., Box 1753, Ptgh.

FURNACES—Heat Treating, Automatic
Hevi Duty Electric Co., Milwaukee.
Holcroft & Co., Detroit.
McCann-Harrison Corp., Cleve.
Rockwell, W. S., Co., 50 Church St., N.Y.C.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.

FURNACES—Heat Treating, Cyanide or Lead
American Electric Furnace Co., Boston.
Amer. Gas Furnace Co., Elizabeth, N. J.
Chicago (Ill.) Flexible Shaft Company.
Hevi Duty Electric Co., Milwaukee.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.

FURNACES—Heat Treating, Electric
Ajax Electrothermic Corp., Trenton, N. J.
American Electric Furnace Co., Boston.
Electric Furnace Co., Salem, Ohio.
Hagan, Geo. J., Co., Pittsburgh.
Hevi Duty Electric Co., Milwaukee.
Holcroft & Co., Detroit.
Hoskins Mfg. Co., Detroit.
Rockwell, W. S., Co., 50 Church St., N.Y.C.
Strong, Carlisle & Hammond Co., Cleve.
Swindell, W. & Bros., Box 1753, Ptgh.

FURNACES—Heat Treating, Oil, Gas or Coal Fired
Amer. Gas Furnace Co., Elizabeth, N. J.
Anthony Co., The, Long Island City, N. Y.
Best, W. N., Corp., 295 5th Ave., N.Y.C.
Chicago (Ill.) Flexible Shaft Company.
Electric Furnace Co., Salem, Ohio.
Hagan, Geo. J., Co., Pittsburgh.
Holcroft & Co., Detroit.
McCann-Harrison Corp., Cleve.
Rockwell, W. S., Co., 50 Church St., N.Y.C.
Smythe, S. R., Co., Inc., The, Ptgh.
Strong, Carlisle & Hammond Co., Cleve.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.
Swindell, W. & Bros., Box 1753, Ptgh.

FURNACES—High-Speed Steel
Ajax Electrothermic Corp., Trenton, N. J.
American Electric Furnace Co., Boston.
Chicago (Ill.) Flexible Shaft Company.
Naismith, Geo., & Son, Ptgh.
Surface Combustion Co., 2375 Dorr St., Toledo.
Swindell, W. & Bros., Box 1753, Ptgh.

FURNACES—Non-Ferrous Melting
Ajax Electrothermic Corp., Trenton, N. J.
American Electric Furnace Co., Boston.
Detroit (Mich.) Electric Furnace Co.
Greene Electric Furnace Co., Seattle, Wash.
Holcroft & Co., Detroit.
Surface Combustion Co., 2375 Dorr St., Toledo.

FURNACES—Open Hearth
Criswell, James, Co., Ptgh.
Holcroft & Co., Detroit.
Laughlin, Alex., & Co., Ptgh.
Naismith, Geo., & Son, Ptgh.
Smythe, S. R., Co., Inc., The, Ptgh.
Stevens, Arthur L., Corp., Chicago.
Swindell, W., & Bros., Box 1753, Ptgh.
Wellman-Seaver-Morgan Co., Cleveland.

FURNACES—Pack Heating Sheets
Wean Engng. Co., Inc., The, Warren, O.

FURNACES—Recuperative
Holcroft & Co., Detroit.
Naismith, Geo., & Son, Ptgh.

FURNACES—Regenerative
Naismith, Geo., & Son, Ptgh.

FURNACES—Rivet Heating
Surface Combustion Co., 2375 Dorr St., Toledo.

FURNACES—Soaking Pit
Naismith, Geo., & Son, Ptgh.

FURNACES—Steel Mill
Naismith, Geo., & Son, Ptgh.

FURNACES—Tube Welding & Bending
Naismith, Geo., & Son, Ptgh.

FURNACES—Wire, Annealing & Galvanizing
Surface Combustion Co., 2375 Dorr St., Toledo.
Vaughn Mchry. Co., Cuyahoga Falls, O.

FURNITURE—Mill and Factory
Vitek Mfg. Co., Omaha, Neb.

FUSE METAL
Platt Bros. & Co., The, Waterbury, Ct.

GAGES—Plug and Ring
Haynes StelLite Co., 30 East 42nd St., N. Y. C.

GAGES—Pressure and Vacuum
Bristol Co., Waterbury, Ct.
Marshalltown (Iowa) Mfg. Co.
Taylor Instrument Companies, Rochester, N. Y.

GAGES—Rolling Mill
Haines Gauge Co., Phila.

GAGES—Thread Lead
Bausch & Lomb Optical Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.

GALVANIZING
Cattie Brothers Corp., Phila.
Cattie, Joseph P., & Bros., Phila.
Harlon-Gregory Galvanizing Co., Ptgh.
Newark (N. J.) Galvanizing Co.

GALVANIZING EQUIPMENT (Electro)
Hanson-Van Winkle-Munning Co., Matawan, N. J.

GALVANIZING PLANTS—For Sheets
Aetna-Standard Eng. Co., Youngstown, O.
Erie (Pa.) Fdry. Co.
United Engng. & Fdry. Co., Ptgh.

GALVANIZING & TINNING EQUIPMENT—Wire
Vaughn Mchry. Co., Cuyahoga Falls, O.

GAS—Exhausters
Roots, P. H. & F. M., Co., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.

GAS CLEANERS
Research Corp., 25 West 43rd St., N. Y. C.

GAS CLEANING PLANTS
Flinn & Dreffein Co., Chicago.

GAS PRODUCERS
Duff Patents Co., Ptgh.
Flinn & Dreffein Co., Chicago.
Swindell, W. & Bros., Box 1753, Ptgh.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Wellman-Seaver-Morgan Co., Cleveland.
Wood, R. D., & Co., Philadelphia.

GAS WASHERS
Brassert, H. A., & Co., Chicago.

GAS—Welding
Linde Air Products Co., 30 E. 42nd St., N. Y. C.
Prest-O-Lite Co., Inc., 30 E. 42nd St., N. Y. C.

GASKETS—Asbestos, Metal or Rubber
Garlock Packing Co., Palmyra, N. Y.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

GASKETS—Felt
Booth Felt Co., inc., The, 477-479 19th St., Bklyn.

GATES—Blast
Rockwell, W. S., Co., 50 Church St., N.Y.C.

GATES—Fence
American Steel & Wire Co., Chicago.

GEAR CUTTING
Acme Mch. Prod. Co., Muncie, Ind.
Akron (O.) Gear & Engng. Co.
Bethlehem (Pa.) Steel Co.
Dundore Mfg. Co., Reading, Pa.
Earle Gear & Machine Co., Phila.
Farrel-Birmingham Co., Inc., Buffalo, N.Y.
Ferguson Gear Co., Gastonia, N. C.
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston.
Hartford (Ct.) Special Mchry. Co.
Hinkley Gear Co., Phila.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Pennsylvania Gear & Mch. Co., Phila.
Philadelphia (Pa.) Gear Works.
Pittsburgh (Pa.) Rolls Corp.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Wellman-Seaver-Morgan Co., Cleveland.

GEAR CUTTING MACHINES
Brown & Sharpe Mfg. Co., Prov., R. I.
Farrel-Birmingham Co., Inc., Buffalo, N.Y.
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland.
Whiton, D. E., Mch. Co., New London, Ct.

GEAR DRIVES—Herringbone
Farrel-Birmingham Co., Inc., Buffalo, N.Y.
Mackintosh-Hemphill Co., Ptgh.

GEAR HOBBING MACHINES
Adams Co., The, Dubuque, Iowa.
Gould & Eberhardt, Newark, N. J.

GEAR PLANING MACHINES
Gleason Works, Rochester, N. Y.

GEAR TESTING MACHINES
Lees-Bradner Co., Cleveland.

GEARS—Bevel
Earle Gear & Machine Co., Phila.
Ferguson Gear Co., Gastonia, N. C.
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston.
Hartford (Ct.) Special Mchry. Co.
Jones, W. A., Foundry & Mach. Co. 4434 W. Roosevelt Road, Chicago.
Philadelphia (Pa.) Gear Works.

GEARS—Double Helical Cut
De Laval Steam Turbine Co., Trenton, N. J.
Farrel-Birmingham Co., Inc., Buffalo, N.Y.

GEARS—Heat Treated
Gleason Works, Rochester, N. Y.

GEARS—Herringbone
Bethlehem (Pa.) Steel Co.
Earle Gear & Machine Co., Phila.
Falk Corp., Milwaukee.
Farrel-Birmingham Co., Inc., Buffalo, N.Y.
Mesta Mch. Co., Ptgh.
Philadelphia (Pa.) Gear Works.

GEARS—Machine Cut
Adams Co., The, Dubuque, Ia.
Gleason Wks., Rochester, N. Y.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Mackintosh-Hemphill Co., Ptgh.

GEARS—Machine Molded
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Poole Engng. & Mch. Co., Balto., Md.

GEARS—Non-Metallic
Akron (O.) Gear & Engng. Co.
Grant Gear Works, Boston.
Horsburgh & Scott Co., Cleve.
Pennsylvania Gear & Mch. Co., Phila.
Philadelphia (Pa.) Gear Works.

GEARS—Rawhide
Ferguson Gear Co., Gastonia, N. C.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.

GEARS—Speed Reducing
Cleveland (O.) Worm & Gear Co.
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Hindley Gear Co., Phila.
Horsburgh & Scott Co., Cleve.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Palmer-Bee Co., Detroit.
Philadelphia (Pa.) Gear Works.
Poole Engng. & Mch. Co., Balto., Md.

GEARS—Spiral
Ferguson Gear Co., Gastonia, N. C.

GEARS—Spur
Boston Gear Works Sales Co., Norfolk Downs, Mass.
Earle Gear & Mach. Co., Phila.
Grant Gear Works, Boston.
Hartford (Ct.) Special Mchry. Co.
Horsburgh & Scott Co., Cleve.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Pennsylvania Gear & Mch. Co., Phila.
Philadelphia (Pa.) Gear Wks.

GEARS—Worm
Akron (O.) Gear & Engng. Co.
Cleveland (O.) Worm & Gear Co.
Ferguson Gear Co., Gastonia, N. C.
Grant Gear Works, Boston.
Hartford (Ct.) Special Mchry. Co.
Hindley Gear Co., Phila.
Horsburgh & Scott Co., Cleve.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Philadelphia (Pa.) Gear Works.

GEARS—Worm, Speed Reducers
Cleveland (O.) Worm & Gear Co.
De Laval Steam Turbine Co., Trenton, N. J.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Philadelphia (Pa.) Gear Works.

GENERATORS—Acetylene
Air Reducing Sales Co., 342 Madison Ave., N. Y. C.
Harris Calorific Co., Cleveland.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

GENERATORS—Electric
Archer & Baldwin, Inc., 126 Liberty St. N. Y. C.

GENERATORS—Electric, Second Hand
Belyea Co., Inc., 147 W. 18th St., N. Y. C.

GENERATORS—Electroplating
Hanson-Van Winkle-Munning Co., Matawan, N. J.

GLOVES—Asbestos and Fireproof
Safety Equipment Service Co., Cleveland, Ohio.

GLUE HEATERS
Dart, E. M., Mfg. Co., Prov., R. I.

GOGGLES—Grinding and Chipping
Safety Equipment Service Co., Cleveland, Ohio.

GOGGLES—Welding
Safety Equipment Service Co., Cleveland, Ohio.

GOVERNORS—Air Compressor
Westinghouse Traction Brake Co., Wilmerding, Pa.

GRATING—Flooring, Sidewalk, Etc.
Blaw-Knox Co., Ptgh.
Hendrick Mfg. Co., Carbondale, Pa.
Irving Iron Works Co., L. I. City, N. Y.

GRATING—Steel
Blaw-Knox Co., Ptgh.

GREASES
Sun Oil Company, Philadelphia.

GRILLES—Metal Cane
Diamond Mfg. Co., Wyoming, Pa.
Excelsior Tool & Mch. Co., East St. Louis, Ill.

GRINDING AND POLISHING MACHINES
Bridgeport (Ct.) Safety Emery Wheel Co., Inc.
Calder, Geo. H., Lancaster, Pa.
Marschke Mfg. Co., Towson, Md.
Hammond Mchry. Builders, Inc., Formerly Hill-Curtis Co., Kalamazoo, Mich.
Ransom Mfg. Co., Oshkosh, Wis.
Reyersford (Pa.) Fdry. & Mch. Co., Inc.
Safety Grinding Wheel & Mch. Co., The, Springfield, O.
Springfield Mfg. Co., Bridgeport, Ct.

GRINDING MACHINE RESTS
Haynes Stellite Co., 30 East 42nd St., N. Y. C.

GRINDING MACHINES—Cam
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES—Cutter and Reamer
Landis Tool Co., Waynesboro, Pa.
Thompson Grinder Co., Springfield, O.

GRINDING MACHINES—Cylindrical
Brown & Sharpe Mfg. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES—Die
Bignall & Keeler Mch. Wks., Edwardsville, Ill.
Landis Mch. Co., Inc., Waynesboro, Pa.

GRINDING MACHINES—Disc
Gardner Mach. Co., Beloit, Wis.
Production Mch. Co., Greenfield, Mass.

GRINDING MACHINES—Drill
Sellers, William, & Co., Inc., Phila.

GRINDING MACHINES—Flexible Shaft
Keller Mechanical Engng. Corp., 78 Washington St., Brooklyn, N. Y.

GRINDING MACHINES—Gear Tooth
Lees-Bradner Co., Cleveland.

GRINDING MACHINES—Internal
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES — Machine Knives
Aikins, E. C., & Co., Indianapolis, Ind.
Bridgeport (Ct.) Safety Emery Wheel Co., Inc.

GRINDING MACHINES—Portable Electric
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.

GRINDING MACHINES—Portable Pneumatic
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Cleveland (O.) Pneumtaic Tool Co., The, Ingersoll-Rand Co., 11 B'way, N. Y. C.
Rotor Air Tool Co., The, Cleveland.

GRINDING MACHINES—Portable, Radial Swing
Mummert-Dixon Co., Hanover, Pa.

GRINDING MACHINES—Roll
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES—Second Hand
Bath, Cyril J. & Co., Cleveland.
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
Morey & Co., Inc., 410 Broome St. N. Y. C.

GRINDING MACHINES—Snagging
Ransom Mfg. Co., Oshkosh, Wis.
Standard Electrical Tool Co., The, Cinci

GRINDING MACHINES—Spring
Sleeper & Hartley, Inc., Worcester, Mass.

GRINDING MACHINES—Surface
Abrasive Machine Tool Co., E. Prov., R. I.
American Mch. Tool Co., Hackettstown, N. J.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport (Ct.) Safety Emery Wheel Co., Inc.

GRINDING MACHINES—Swing Frame
Marschke Mfg. Co., Towson, Md.
Safety Grinding Wheel & Mch. Co., The, Springfield, O.

GRINDING MACHINES—Tool
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Cinn.
Ransom Mfg. Co., Oshkosh, Wis.
Sellers, William, & Co., Inc., Phila.
Taylor & Fenn Co., Hartford, Ct.

GRINDING MACHINES—Universal
Landis Tool Co., Waynesboro, Pa.
Simmons Mach. Tool Corp., Albany, N. Y.
Thompson Grinder Co., Springfield, O.

GRINDING MACHINES—Valve
Defiance (O.) Machine Works

GRINDING MACHINES—Vertical Surface
Blanchard Mach. Co., Cambridge, Mass.

GRINDING WHEEL DRESSERS AND CUTTERS
Atkins, E. C., & Co., Indianapolis, Ind.
Calder, Geo. H., Lancaster, Pa.
Dickinson, Thos. L., 34 Gold St., N. Y. C.

GRINDING WHEELS
Atkins, E. C., & Co., Indianapolis, Ind.
Bakelite Corp., 247 Park Ave., N. Y. C.
Carborundum Co., The, Niagara Falls, N. Y.
New York Belting & Packing Co., 91-93 Chambers St., N. Y. C.
Safety Grinding Wheel & Mch. Co., The, Springfield, O.
Springfield Mfg. Co., Bridgeport, Ct.

GUARDS—Machinery
Buffalo (N. Y.) Wire Wks. Co., Inc.

GUTTERS
Newport (Ky.) Rolling Mill Co.

HACK SAW BLADES—See Saws—Hack Saw Blades

HACK SAW MACHINES
Atkins, E. C., & Co., Indianapolis, Ind.
Armstrong-Blum Mfg. Co., Chicago.
Diamond Saw & Stamping Wks., Buffalo
Peerless Machine Co., Racine, Wis.
Racine Tool & Mch. Co., 1755 State St., Racine, Wis.

HAMMER RAMS
Heppenstall Forge & Knife Co., Ptgh.

HAMMERS—Air
Nazel Engrg. & Mch. Wks., Phila.

HAMMERS—Belt or Motor Driven (Forging)
Barber-Stockwell Co., Cambridge, Mass.
Bradley, C. C., & Son, Inc., Syracuse
Moloch Fdry. & Mch. Co., Kaukauna, Wis.
Nazel Engrg. & Mch. Wks., Phila.
Sutton Engng. Co., Ptgh.

HAMMERS—Belt or Motor Driven (Sheet Metal)
Quickwork Co., The (Not Incorporated—B. Collier Smith, Owner), St. Mary's Ohio.
Yoder Co., The, Cleveland.

HAMMERS—Blacksmiths' Forging
Bradley, C. C., & Son, Inc., Syracuse, N.Y.

HAMMERS—Board Drop
Erie (Pa.) Fdry. Co.

HAMMERS—Drop
Erie (Pa.) Fdry. Co.
Merrill Bros., Maspeth, N. Y.
Miner & Peck Dept., Farrel-Birmingham Co., Inc., Derby, Conn.
Morgan Engng. Co., Alliance, O.
Standard Machinery Co., Auburn, R.I.

HAMMERS—Pneumatic
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Cleveland (O.) Pneumatic Tool Co., The
Ingersoll-Rand Co., 11 B'way, N. Y. C.

HAMMERS—Pneumatic Forging
Sullivan Machinery Co., Chicago.

HAMMERS—Steam
Erie (Pa.) Fdry. Co.
Morgan Engng. Co., Alliance, O.

HANGERS—Factory Door
Myers, F. E., & Bro. Co., Ashland, O.

HANGERS—Shaft
American Pulley Co., Philadelphia
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Hyatt Roller Bearing Co., Newark, N. J.
Hyman, Joseph, & Sons, Phila.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.

HARDNESS TESTING MACHINES
Olsen, Tinius Testing Mch. Co., Phila.
Shore Instrument & Mfg. Co., Inc., Jamaica, L. I., N. Y.
Wilson-Maeulen Co., Inc., 738 E. 143d St., N. Y. C.

HARDWARE—Carriage and Wagon
Clapp, E. D., Mfg. Co., The, 86 S. Division St., Auburn, N. Y.
Cleveland (O.) Hardware Co.

HEADING MACHINES
National Mchry. Co., Tiffin, Ohio.

HEAT RESISTING PRODUCTS—Electric
Globar Corp., Niagara Falls, N. Y.

HEAT TREATING
General Machine Wks., York, Pa.
Matthews Mfg. Co., Worcester, Mass.
Parish Pressed Steel Co., Reading, Pa.

HEATING RESISTANCE—Non-Metallic
Globar Corp., Niagara Falls, N. Y.

HEATING AND VENTILATING APPARATUS
Buffalo (N. Y.) Forge Co., 492 B'way

HINGES—Wrought Brass Butt
Veeder-Root, Inc., Hartford, Ct.

HINGES—Wrought Steel & Brass
Hager, C., & Sons Hinge Mfg. Co., St. Louis, Mo.

HOISTING MACHINES
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS—Air
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Duke Engine Co., Grand Haven, Mich.
Detroit (Mich.) Hoist & Mach. Co.
Hanna Eng. Works, Chicago.
Independent Pneumatic Tool Co., Chicago.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Northern Engng. Wks., 212 Chene St., Detroit.
Whiting Corp., Harvey, Ill.

HOISTS—Chain
American MonoRail Co., The, Cleveland.
Armington Engng. Co., Euclid, Ohio.
Ford Chain Block Co., Phila.
Union Mfg. Co., New Britain, Conn.
Wright Mfg. Co., Bridgeport, Ct.
Yale & Towne Mfg. Co., Stamford, Ct.

HOISTS—Electric
American Crane Co., Inc., The, Friendship, N. Y.
American Engng. Co., Aramingo and Cumberland Sts., Philadelphia.
American MonoRail Co., The, Cleveland.
Box Crane & Hoist Corp., Phila.
Detroit (Mich.) Hoist & Mach. Co.
Euclid (O.) Crane & Hoist Co.
Harnischfeger Corp., Milwaukee.
Mallory Machry. Corp., Baltimore.
Maris Brothers, Inc., Phila.
Milwaukee (Wis.) Elec. Crane & Hoist Corp.
Northern Engng. Wks., 212 Chene St., Detroit.
Payne, N. B., Co., 25 Church St., N. Y. C.
Roeper Crane & Hoist Works, Inc., Reading, Pa.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Yale & Towne Mfg. Co., Stamford, Ct.

HOISTS—Electric Traveling
American Engng. Co., Aramingo and Cumberland Sts., Philadelphia.
Box Crane & Hoist Corp., Phila.
Euclid (O.) Crane & Hoist Co.
Harnischfeger Corp., Milwaukee.
Milwaukee (Wis.) Elec. Crane & Hoist Corp.
Northern Engng. Wks., 212 Chene St., Detroit.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS—Monorail
American Engng. Co., Aramingo and Cumberland Sts., Philadelphia.
Armington Engng. Co., Euclid, Ohio.
Euclid (O.) Crane & Hoist Co.
Milwaukee (Wis.) Elec. Crane & Hoist Corp.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS—SKIP
Bartlett, C. O. & Snow Co., Cleve.

HOLDERS—Nipple
Curtis & Curtis Co., Bridgeport, Ct.

HONING MACHINES
Barnes Drill Co., Inc., Rockford, Ill.

HOOKS—Wire
Titchener, E. H., & Co., Binghamton, N. Y.

HOOPS AND BANDS
Ryerson, Jos. T. & Son, Inc., Chicago.
Sharon (Pa.) Steel Hoop Co.

HOOPS—Wire
American Steel & Wire Co., Chicago.

HOSE—Air, Oil, Steam and Water
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
New York Belting & Packing Co., 91-93 Chambers St., N. Y. C.

HYDRANTS—Fire
Kennedy Valve Mfg. Co., Elmira, N. Y.
Wood, R. D., & Co., Philadelphia.

HYDRAULIC MACHINERY
American Fluid Motors Co., 2410 Aramingo Ave., Philadelphia.
Anker Engng. Co., Phila.
Bethlehem (Pa.) Steel Co.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Chambersburg (Pa.) Engrg. Co.
Elmes, Chas. F., Engrg. Wks., Chicago.
French Oil Mill Mchry. Co., Piqua, O.
Lake Erie Engng. Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Watson Stillman Co., 71 West St., N. Y. C.
Wood, R. D., & Co., Philadelphia.

HYDROGEN
International Oxygen Co., Newark, N. J.

HYPODERMIC NEEDLE TUBING
Summerill Tubing Co., Bridgeport, Montgomery County, Pa.

ICE HANDLING MACHINERY
Lewis-Shepard Co., 122 Walnut St., Watertown Station, Boston.

INDUCTION STEEL ELECTRIC
Heppenstall Forge & Knife Co., Ptgh.

INGOT MOLDS
Bethlehem (Pa.) Steel Co
Gathmann Engineering Co., Baltimore, Md.
Shenango-Penn Mold Co., Pgh.
Valley Mould & Iron Corp., Hubbard, O.

INGOTS—Aluminum
Erdle Perforating Co., Rochester, N. Y.
Leavitt, C. W., & Co., 30 Church St. N. Y. C.

INGOTS—Phosphor Bronze
Phosphor Bronze Smelting Co., Phila.

INSTRUMENTS—Recording
Bristol Co., Waterbury, Ct.
Brown Instrument Co., The, Philadelphia.
Taylor Instrument Companies, Rochester, N. Y.

INSULATION—Cork
Armstrong Cork & Insulation Co., Lancaster, Pa.

INSULATION—Heat (Brick, Sheet and Cement)
Armstrong Cork & Insulation Co., Lancaster, Pa.

INSULATION—Sound
Armstrong Cork & Insulation Co., Lancaster, Pa.

INSULATION—Magnesia
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

IRON OR STEEL—Swedish
Swedish-American Steel Corp., 427 Kent Ave., Brooklyn, N. Y.

IRON BARS
Lockhart Iron & Steel Co., Ptgh.
Wrought Iron Company of America, Lebanon, Pa.

IRON—Chain
Bethlehem (Pa.) Steel Co.

IRON—Forging Blooms
Lockhart Iron & Steel Co., Ptgh.

IRON—(Genuine Open Hearth Iron)
Newport (Ky.) Rolling Mill Co.

IRON—Rustless
Rustless Iron Corp. of America, 122 E. 42nd St., N. Y. C.

IRON—Stainless
Firth-Sterling Steel Co., McKeesport, Pa.

IRON—Staybolt
Bethlehem (Pa.) Steel Co.
Lockhart Iron & Steel Co., Ptgh.
Ryerson, Jos. T., & Son, Inc., Chicago.
Wrought Iron Company of America, Lebanon, Pa.

JIGS, FIXTURES, TOOL, ETC.—See Tools, Jigs, Fixtures, Etc.

KEYS—Machine
Buffalo (N. Y.) Mch. Key Co.
Leard, William Co., New Brighton, Pa.

KEYS—Riveted
Western Wire Products Co., St. Louis.

KEYSEATING MACHINES
Baker Br s., Inc., Toledo, O.

KILNS—Ceramic
Holcroft & Co., Detroit.

LACING—Belt, Rawhide or Leather
Graton & Knight Co., Worcester, Mass.

LACQUERS—Wood and Metal
Varnish Products Co., Cleveland.

LADLES
Whiting Corp., Harvey, Ill.

LAMPS—Mercury Vapor
Cooper Hewitt Electric Co., Hoboken, N. J.

LATHE CENTERS
Steinle Turret Machine Co., Madison, Wis.

LATHES—Automatic
Bullard Co., The, Bridgeport, Ct.
Jones & Lamson Mch. Co., Springfield, Vt
LeBlond, R. K., Mch. Tool Co., Cinn.
Monarch Mch. Tool Co., The, Sidney, O.

LATHES—Bench
Rivett Lathe & Grinder Corp., Boston.
South Bend (Ind.) Lathe Works.

LATHES—Chucking
Jones & Lamson Mach. Co., Springfield, Vt.

LATHES—Crankshaft
LeBlond, R. K., Mch. Tool Co., Cinn.

LATHES—Engine
American Tool Works Co., Cinci.
Cincinnati (O.) Lathe & Tool Co.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Hendey Mch. Co., Torrington, Ct.
Hill, Clarke & Co. of Chicago, 647 W. Washington Blvd.
LeBlond, R. K., Mch. Tool Co., Cinn
Lodge & Shipley Mch. Tool Co., Cinci.
Monarch Mch. Tool Co., The, Sidney, O.
Osborne & Sexton Mchry. Co., Columbus, O.
Reed-Prentice Corp., Worcester, Mass.
Ryerson, Jos. T. & Son, Inc., Chicago.
Sidney (Ohio) Machine Tool Co.
South Bend (Ind.) Lathe Works.

LATHES—Gap Bed
South Bend (Ind.) Lathe Works.

LATHES—Roll
Mesta Mch. Co., Ptgh.
United Engrg. & Fdy. Co., Ptgh.

LATHES—Second-Hand
Bath, Cyril J. & Co., Cleveland.
Botwinik Bros., Inc., New Haven, Ct.
Brownell Mchry. Co., Prov., R. I.
Eastern Mchry. Co., Cincinnati.
Harris Bros. Co., Chicago.
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
Miles Mchry. Co., Saginaw, W. S., Mich.
Morey & Co., Inc., 410 Broome St., N.Y.C.
Russell Mch. Co., Ptgh.
Simmons Mach. Tool Corp., Albany, N. Y.

LATHES—Spinning
Adriance Mach. Works, Inc., 82 Richards St., Brooklyn, N. Y.

LATHES—Turret
Acme Mch. Tool Co., Cincinnati.
Bardons & Oliver, Cleve.
Bullard Co., The, Bridgeport, Ct.
Cincinnati (O.) Lathe & Tool Co.
Jones & Lamson Mch. Co., Springfield, Vt.
Steinle Turret Machine Co., Madison, Wis.

LEAD BURNING
Gross Lead Burning & Coating Corp., Cleveland.

LEAD BURNING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

LEAD-LINED APPARATUS
Gross Lead Burning & Coating Corp., Cleveland.

LEATHER—Cup
Graton & Knight Co., Worcester, Mass.

LEATHER—Hydraulic
Graton & Knight Co., Worcester, Mass.

LEGGINGS—Safety
Safety Equipment Service Co., Cleveland, Ohio.

LEVELING MACHINES
Wean Engng. Co., Inc., The, Warren, O.

LEVELS—Precision Machine Aligning
Universal Boring Mch. Co., Hudson, Mass.

LIMESTONE—Low Silica
Baker, J. E., Co., York, Pa.

LINING—Converter
Edge Hill Silica Rock Co., New Brunswick, N. J.

LINING—Cupola
Edge Hill Silica Rock Co., New Brunswick, N. J.

LIQUIDATORS
Foster, Frank B., Pittsburgh.
Llewelyn, Thomas J., & Co., Ptgh.

LOCK WASHER MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

LOCKS
Yale & Towne Mfg. Co., Stamford, Ct.

LOCOMOTIVES—Electric
Atlas Car & Mfg. Co., Cleve.

LOCOMOTIVES—Gasoline
Plymouth (O.) Locomotive Wks.

LOCOMOTIVES—Industrial
Plymouth (O.) Locomotive Wks.
Porter, H. K., Co., Ptgh.

LOCOMOTIVES—Second Hand
Hyman-Michaels Co., Chicago.

LOCOMOTIVES—Steam
Porter, H. K., Co., Ptgh.

LOCOMOTIVES—Storage Battery
Atlas Car & Mfg. Co., Cleve.

LUBRICANTS
Sun Oil Co., Philadelphia.

LUGS—Terminal
Wolverine Tube Co., Detroit.

LUMBER—Creosoted or Zinc Treated
Century Wood Preserving Co., Ptgh.
Jennison-Wright Co., Toledo, O.

MACHINE WORK
Cavagnaro, John J., Harrison, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Columbia Mch. Works & M. I., Co., 275 Chestnut St., Bklyn, N. Y.
Cowdrey, C. H., Machine Works, 30 Summer St., Fitchburg, Mass.
Fabricated Steel Products Co., Wheeling, W. Va.
Franklin Mch. Co., Providence, R. I.
General Mach. Works, York, Pa.
Huhn Mfg. Co., Highbridge, N. Y. C.
Johnson, Carlyle, Mach. Co., Manchester, Ct.
Lambert & Todd Mach. Co., Camden, N. J.
Moloch Fdry. & Mch. Co., Kaukauna, Wis.
Mianus Diesel Engine Co., Stamford, Ct.
National Equipment Co., Springfield, Mass.
Porter Mch. Co., Inc., Jersey City, N. J.
Root, H. M. Co., York, Pa.
Royersford (Pa.) Fdry. & Mch. Co., Inc.
Scofield, Gilbert J., Co., Inc., Albany, N. Y.

MACHINERY DEALERS
Adams, Ogden R., Rochester, N. Y.
Asher Mchry. Co., Newark, N. J.
Bath, Cyril J. & Co., Cleveland.
Bennett Mchry. Co., 30 Church St. New York City.
Bertolette Mch. Tool Co., Inc., Jersey City, N. J.
Brotherhood, Percy M., & Son, 25 Church St., N. Y. C.
Botwinik Bros., Inc., New Haven, Conn.
Brownell Mchry. Co., Prov., R. I.
Cyphers, H. E., Newark, N. J.
Delta Equip. Co., Phila.
Dony, D. E., Rochester, N. Y.
Eastern Mchry. Co., Cincinnati.
Eddy, E. A., Mchry. Co., Inc., Providence, R. I.
Firm Purchasing Corp., 1 Hanson Place, Brooklyn, N. Y.
General Mchry. Corp., Boston, Mass.
Harris Bros. Co., Chicago.
Hill, Clarke & Co. of Chicago, 647 W. Washington Blvd., Chicago.
Johnson, Wm. C., & Sons Mchry. Co., St. Louis, Mo.
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
MacCabe, T. B., Philadelphia, Pa.
Marr-Galbreath Mchry. Co., Ptgh.
Miles Mchry. Co., Saginaw, W. S., Mich.
Moyer, J. N., Philadelphia.
Morey & Co., Inc., 410 Broome St., N.Y.C.
O'Brien Mchry. Co., Phila.
Pettler, P., & Son, Beaver Falls, Pa.
Randle Machinery Co., 1772 Powers St., Cincinnati
Reliance Mchry. Sales Co., Ptgh.
Riverside Mchry. Depot, Detroit.
Ryerson, Jos. T., & Son, Inc., Chicago.
Schoonmaker, A. G., & Sons, Inc., 30 Church St., N. Y. C.
Severin Mchry. Corp., 30 Church St., N. Y. C.
Simmons Mach. Tool Corp., Albany, N. Y.
Smith, H. A., Mchry. Co., Syracuse, N. Y.
Stocker-Romeiy-Wachs Co., Chicago.
Strafer Mchry. Co., Jersey City, N. J.
Sun Mchry. Co., Inc., Newark, N. J.
West Penn Mchry. Co., Ptgh.
White, A. D. Machry. Co., Chicago.

MACHINISTS—Contracting
Konigslow, Otto, Mfg. Co., Cleve.

MAGNESITE—Brick or Dead Burnt
Carborundum Co., The, Niagara Falls, N. Y.
Lavino, E. J., & Co., Phila.

MAGNETS—Lifting
Cutler-Hammer, Inc., Milwaukee.
Electric Controller & Mfg. Co., Cleve.
Ohio Electric & Controller Co., Cleve.

MANGANESE METAL
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.

MARKING MACHINES
Noble & Westbrook Mfg. Co., Hartford Ct.

METAL SPECIALTIES
American Pulley Co., Philadelphia
Amer. Spring & Mfg. Corp., Holley, Mich.
Bossert Corp., The, Utica, N. Y.
Columbia Mch. Works & M. I. Co., 275 Chestnut St., Bklyn, N. Y.
Cuyahoga Spring Co., Cleve.
Detroit (Mich.) Metal Specialty Corp.
Globe Mach. & Stpg. Co., Cleve.
Matthews Mfg. Co., Worcester, Mass.
Metal Specialty Co., Cincinnati.
Torrington (Ct.) Co.
Worcester (Mass.) Stamped Metal Co.
York (Pa.) Corrugating Company.

METALINE
Rhoades, R. W., Metaline Co., Inc., Long Island City, N. Y.

MICA SCHIST
Edge Hill Silica Rock Co., New Brunswick, N. J.

METERS—Electric Flow—For Steam, Gas, Air or Water
Brown Instrument Co., The, Philadelphia.

METERS—CO2
Brown Instrument Co., The, Philadelphia.

MICROSCOPES—Toolmakers
Bausch & Lomb Optical Co., Rochester, N. Y.

MILLING CUTTER BLADES
N. Y. C.
Haynes Stellite Co., 30 East 42nd St.,

MILLING MACHINES—Horizontal
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Defiance (O.) Mch. Wks.
Hendey Mch. Co., Torrington, Ct.
Kearney & Trecker Corp., Milwaukee.

MILLING MACHINES—Plain
Kearney & Trecker Corp., Milwaukee.
Ryerson, Jos. T., & Son, Inc., Chicago.

MILLING MACHINES—Planer Type
Manning, Maxwell & Moore, Inc., 100 E. 42nd St., N. Y. C.
Sellers, William, & Co., Inc., Phila.

MILLING MACHINES—Second-Hand
Bath, Cyril J. & Co., Cleveland.
Botwinik Bros., Inc., New Haven, Ct.
Eastern Mchry. Co., Cincinnati.
Harris Bros. Co., Chicago.
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
Simmons Mach. Tool Corp., Albany, N. Y.

MILLING MACHINES—Universal
Brown & Sharpe Mfg. Co., Prov., R. I.
Ryerson, Jos. T., & Son, Inc., Chicago.

MILLING MACHINES—Vertical
Reed-Prentice Corp., Worcester, Mass.

MIXING MACHINES—Sand
Bartlett, C. O. & Snow Co., Cleve.
National Engineering Co., Chicago.

MOLDING MACHINES—Jarring (Air)
Arcade Mfg. Co., Freeport, Ill.
Herman Pneumatic Mch. Co., Pittsburgh.
Nicholls, Wm. H., Co., Inc., 91st Ave. & 126th St., Richmond Hill, N. Y.

MOLDING MACHINES—Rollover (Hand and Power Operated)
Arcade Mfg. Co., Freeport, Ill.
Herman Pneumatic Mch. Co., Pittsburgh.

MOLDING MACHINES—Sand Throwing
Beardsley & Piper Co., Chicago, Ill.

MOLDING MACHINES—Stripping Plate
Nicholls, Wm. H., Co., Inc., 91st Ave. & 126th St., Richmond Hill, N. Y.

MONORAIL—Overhead
American MonoRail Co., The, Cleveland.

MONORAIL SWITCHES AND TURNTABLES
Yale & Towne Mfg. Co., Stamford, Ct.

MOTORS—Electric
Allis-Chalmers Mfg. Co., Milwaukee.
Century Electric Co., St. Louis
Leland Electric Co., The, Dayton, O.
Ohio Electric & Controller Co., Cleve.

MOTORS—Electric, Second-Hand
Archer & Baldwin, Inc., 126 Liberty St., N. Y. C.
Belyea Co., Inc., 117 W. 18th St., N. Y.
Botwinik Bros., Inc., New Haven, Ct.
Delta Equip. Co., Phila.
Land, L. J., 207 Centre St., N. Y. C.
O'Brien Machry. Co., Phila.
Sachsenmaier, Geo., Co., Phila., Pa.

MOULDINGS—Cold Rolled
Britesun, Inc., Chicago.

NAILS—Cement Coated
American Steel & Wire Co., Chicago.

NAILS—Copper
Hassall, John, Inc., Clay & Oakland Sts., Brooklyn, N. Y.

NAILS—Galvanized
American Steel & Wire Co., Chicago.

NAILS—Wire
American Steel & Wire Co., Chicago.
Bethlehem (Pa.) Steel Co.
Hassall, John, Inc., Clay & Oakland Sts., Brooklyn, N. Y.
Wheeling (W. Va.) Steel Corp.
Youngstown (O.) Sheet & Tube Co.

NICKEL ANODES—Rolled or Cast
Seymour (Ct.) Mfg. Co.

NITROGEN
Air Reduction Sales Co., 342 Madison Ave., N. Y. C.
Linde Air Prods. Co., The, 30 E. 42nd St., N. Y. C.

NUMBERING MACHINES—For Metal
Noble & Westbrook Mfg. Co., Hartford, Ct.

NUT MAKING MACHINERY
National Mchry. Co., Tiffin, Ohio.

NUTS—Acorn
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Western Screw Products Co., St. Louis

NUTS—Castellated
National Acme Co., The, Cleveland.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Western Screw Products Co., St. Louis.

NUTS—Cold Punched
Lake Erie Bolt & Nut Co., The, Cleveland.
Milton (Pa.) Mfg. Co.
Pittsburgh (Pa.) Screw & Bolt Corp.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS—Hot Pressed
Lake Erie Bolt & Nut Co., The, Cleveland.
Milton (Pa.) Mfg. Co.
Pittsburgh (Pa.) Screw & Bolt Corp.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Wrought Iron Co. of Amer., Lebanon, Pa.

NUTS—Milled
Ferry Cap & Set Screw Co., Cleveland.
Pittsburgh (Pa.) Screw & Bolt Corp.
Westfield (Mass.) Nut Co.

NUTS—Semi-Finished
Lake Erie Bolt & Nut Co., The, Cleveland.
Milton (Pa.) Mfg. Co.
Pittsburgh (Pa.) Screw & Bolt Corp.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Westfield (Mass.) Nut Co.

NUTS—Thumb Malleable
Philadelphia (Pa.) Hardware & Malleable Iron Wks., Inc.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

OIL STONES
Carborundum Co., The, Niagara Falls, N. Y.

OILS—Cutting
Sun Oil Company, Philadelphia.

OILS—Fuel
Sun Oil Company, Philadelphia.

ORES—Chrome, Lump and Ground
Lavino, E. J., & Co., Phila.

ORES—Iron
Cleveland (O.) Cliffs Iron Co.
Hanna, M. A., Co., The, Cleveland.
Pilling & Co., Inc., Phila.
Rogers Brown & Crocker Bros., Inc., 21 East 40th St., N. Y. C.
Shenango-Penn Mold Co., Pgh.

ORES—Manganese
Lavino, E. J., & Co., Phila.

OVENS—Baking
Drying Systems, Inc., Chicago, Ill.
Gehnrich Oven Co., Inc., Long Island City, N. Y.
McCann-Harrison Corp., Cleve.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.
Young Bros. Co., Detroit.

OVENS—Core
Drying Systems, Inc., Chicago, Ill.
Gehnrich Oven Co., Inc., Long Island City, N. Y.
Holcroft & Co., Detroit.
McCann-Harrison Corp., Cleve.
Maehler, Paul Co., The, Chicago.
Steiner Oven Co., Newark, N. J.
Young Bros. Co., Detroit.

OVENS—Drying
Detroit (Mich.) Sheet Metal Wks.
Drying Systems, Inc., Chicago, Ill.
McCann-Harrison Corp., Cleve.
Maehler, Paul Co., The, Chicago.
Steiner Oven Co., Newark, N. J.
Young Bros. Co., Detroit.

OVENS—Enameling and Japanning
Carborundum Co., The, Perth Amboy, N. J.
Drying Systems, Inc., Chicago, Ill.
McCann-Harrison Corp., Cleve.
Maehler, Paul Co., The, Chicago
Steiner Oven Co., Newark, N. J.
Surface Combustion Co., 2375 Dorr St., Toledo, Ohio.
Young Bros. Co., Detroit.

OVERHEAD CARRYING EQUIPMENT—See Monorail—Overhead

OXYGEN
Air Reduction Sales Co., 342 Madison Ave., N. Y. C.
International Oxygen Co., Newark, N. J.
Linde Air Prods. Co., 30 E. 42nd St., N. Y. C.

PACKING—Leather
Graton & Knight Co., Worcester, Mass.
Watson-Stillman Co., 71 West St., N. Y

PACKING—Metallic
Garlock Packing Co., Palmyra, N. Y.

PACKING—Sheet Asbestos or Rubber
Garlock Packing Co., Palmyra, N. Y.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

PAINT—Aluminum
Varnish Products Co., Cleveland.

PANS—Grinding
National Engineering Co., Chicago.

PATENT ATTORNEYS
Boyle, John, Jr., Washington, D. C.

PATENTING EQUIPMENT—Wire
Vaughn Mchry. Co., Cuyahoga Falls, O.

PATTERNS—Wood and Metal
Bascom & Co., Troy, N. Y.
Columbia Mch. Works & M. I. Co., 275 Chestnut St., Bklyn., N. Y.

PERFORATED METAL
Chicago Perforating Co., Chicago, Ill.
Cross Engineering Co., Carbondale, Pa.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.
Harrington & King Perforating Co., Chi.
Hendrick Mfg. Co., Carbondale, Pa.
Mundt, Chas., & Sons, Jersey City, N. J.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

PHOSPHOR—Copper
Phosphor Bronze Smelting Co., Phila.

PHOTO MICROGRAPHIC APPARATUS
Bausch & Lomb Optical Co., Rochester, N. Y.

PICKLING COMPOUNDS
American Chemical Paint Co., Ambler, Pa.

PICKLING MACHINES
Aetna-Standard Eng. Co., Youngstown, O.
Mesta Mch. Co., Ptgh.
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.

PIG IRON
Alan Wood Steel Co., Conshohocken, Pa.
Bethlehem (Pa.) Steel Company.
Chateaugay Ore & Iron Co., 26 Liberty St., N. Y. C.
Cleveland (O.) Cliffs Iron Co.
Hanna, M. A., Co., The, Cleveland.
Lavino, E. J., & Co., Phila.
Marshall, F. W., & Co., Philadelphia
Pilling & Co., Inc., Phila.
Republic Iron & Steel Co., Youngstown, O.
Rogers Brown & Crocker Bros., Inc., 21 East 40th St., N. Y. C.
Shenango-Penn Mold Co., Ptgh.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tennessee Coal, Iron & R.R. Co., Birmingham, Ala.
Walter-Wallingford & Co., Cinci.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

PIG IRON—Charcoal
Superior Charcoal Iron Co., Grand Rapids, Mich.

PIG IRON—Low Phosphorus
Chateaugay Ore & Iron Co., 26 Liberty St., N. Y. C.

PILING—Creosoted
Jennison-Wright Co., Toledo.

PILING—Steel Sheet
Bethlehem (Pa.) Steel Company.
Wemlinger, Inc., 149 Broadway, N. Y. C.

PILLOW BLOCKS
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.

PINIONS—Rolling Mill
Mesta Mch. Co., Ptgh.

PINIONS—Wire and Rod
Rathbone, A. B., & J., Palmer, Mass.

PINS—Cotter
Lamson & Sessions Co., The, Cleveland, O.

PINS—Escutcheon
Hassall, John, Inc., Clay & Oakland Sts., Brooklyn, N. Y.

PIPE—Brass or Copper
American Brass Co., Waterbury, Ct.

PIPE—Cast Iron, B. & S. and Flanged
Cornell & Underhill, Spring & Greenwich Sts., N. Y. C.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Wood, R. D., & Co., Philadelphia.

PIPE—Chrome Alloy
Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.

PIPE—Forged Steel
Kellogg, M. W., Co., The, 225 Bdway., N. Y. C.

PIPE—Fusion Welded
Petroleum Iron Wks. Co., Sharon, Pa.

PIPE—Genuine Wrought Iron
Keating, E. F., Co., 452 Water St. N. Y. C.

PIPE—New and Second-Hand
Albert & Davidson Pipe Corp., 2nd Ave., 50-51st St., Bklyn., N. Y.
Albert Pipe Supply Co., Inc., Berry and N. 13th St., Bklyn, N. Y.
Atlantic Steel & Pipe Corp., Stewart Ave. and Meadow St., Brooklyn, N. Y.
Greenpoint Iron & Pipe Co., Inc., 187-197 Maspeth Ave., Bklyn, N. Y.
L. & D. Pipe Supply Co., Inc., 1100 Flushing Ave., Bklyn, N. Y.
Marine Metal & Supply Co., 167 South St., N. Y. C.

PIPE—Riveted Steel
Abendroth & Root Mfg. Co., Newburgh, N. Y.

PIPE—Seamless Iron
Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.

PIPE—Seamless Steel
Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.

PIPE—Spiral Riveted
Abendroth & Root Mfg. Co., Newburgh, N. Y.
Taylor Forge and Pipe Works, Chicago.

PIPE—Standard, Black and Galvanized
Bethlehem (Pa.) Steel Co.
Jones & Laughlin Steel Corp., Ptgh.
Keating, E. F., Co., 452 Water St., N. Y. C.
Republic Iron & Steel Co., Youngstown, O.
Wheeling (W. Va.) Steel Corp.
Youngstown (O.) Sheet & Tube Co.

PIPE—Wrought Iron
Keating, E. F., Co., 452 Water St., N. Y. C.

PIPE BENDING MACHINES
Newbold, R. S., & Son Co., Norristown, Pa.

PIPE BENDS
Cornell & Underhill, Spring & Greenwich Sts., N. Y. C.

PIPE COVERING—Asbestos
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

PIPE COVERING—Cork
Armstrong Cork & Insulation Co., Lancaster, Pa.

PIPE CUTTING MACHINES
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
Newbold, B. S., & Son Co., Norristown, Pa.

PIPE CUTTING AND THREADING MACHINES
Aetna-Standard Eng. Co., Youngstown, O.
Bignall & Keeler Mch. Wks., Bowersville, Ill.
Curtis & Curtis Co., 327 Garden St., Bridgeport, Ct.
Jarecki Mfg. Co., Erie, Pa.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
Pipe Machy. Co., The, Cleve.
Saunders, The Sons, Yonkers, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Williams Tool Corp., Erie, Pa.

PIPE FITTINGS
Kellogg, M. W. Co., The, 225 Bdway, N. Y. C.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Jarecki Mfg. Co., Erie, Pa.

PISTON & PISTON RING MACHINES
Cleveland (O.) Automatic Mch. Co., The.

PISTON RODS
Heppenstall Forge & Knife Co., Pgh.

PLANING MACHINES—Metal
American Tool Works Co., Cinci.
Cincinnati (O.) Planer Co., The.
Cleveland (O.) Planer Co., The.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Gray, G. A., Co., Cinci.
Liberty Mch. Tool Co., Hamilton, O.
Manning, Maxwell & Moore, Inc., 100 E. 42nd St., N. Y. C.
Ryerson, Jos. T., & Son, Inc., Chicago.
Sellers, William, & Co., Inc., Phila.

PLANING MACHINES—Open Side
Cincinnati (O.) Planer Co., The.
Cleveland (O.) Planer Co., The.
Gray, G. A., Co., Cinci.
Liberty Mch. Tool Co., Hamilton, O.

PLANING MACHINES—Second Hand
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
Miles Mchy. Co., Saginaw, W. S., Mich.

PLANTS FOR SALE
Rockaway (N. J.) Rolling Mill, The.

PLATERS' CLEANING COMPOUND
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., 22 Thames St., N. Y.

PLATES—Cellar Door or Floor
Alan Wood Steel Co., Conshohocken, Pa.
American Pressed Steel Co., Phila.
Carnegie Steel Co., Pgh.
Central Iron & Steel Co., Harrisburg, Pa.

PLATES—Felloe
Wrought Washer Mfg. Co., Milwaukee.

PLATES—Iron or Steel
Alan Wood Steel Co., Conshohocken, Pa.
American Pressed Steel Co., Philadelphia.
American Rolling Mill Co., Middletown, Ohio.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Central Iron & Steel Co., Harrisburg, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pgh.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Tennessee Coal, Iron & Railroad Co. Birmingham, Ala.
Youngstown (O.) Sheet & Tube Co.

PLATES—Manganese Steel
Manganese Steel Forge Co., Phila.

PLATFORMS—Lift Truck
Lewis-Shepard Co., 122 Walnut St. Watertown Station, Boston.

PLATING EQUIPMENT—Automatic
Hanson-Van Winkle-Munning Co., Matawan, N. J.

PLUGS—Core Hole
Hubbard, M. D., Spring Co., Pontiac, Mich.

PLUMBING FIXTURES—Brass
Enterprise Brass Works, Muskegon Heights, Mich.

POINTING & THREADING MACHINERY
Economy Engng. Co., The, Willoughby, O.

POLISHING & BUFFING MACHINES
Divine Brothers Co., Utica, N. Y.
Hammond Machy. Builders, Inc., Formerly Hill-Curtis Co., Kalamazoo, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

POLISHING MACHINES—Belt
Production Mch. Co., Greenfield, Mass.

POLISHING WHEELS
Divine Brothers Co., Utica, N. Y.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

POSTS—Steel Fence
American Steel & Wire Co., Chicago.

POWDERED COAL EQUIPMENT—See Pulverized Coal Equipment

POTENTIOMETERS
Brown Instrument Co., The, Philadelphia.

POWER TRANSMITTING MACHINERY
American Pulley Co., Philadelphia.
Caldwell, H. W., & Son Co., Chicago.
Falk Corp., Milwaukee.
Falls Clutch & Mchy. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Schultz, A. L., & Son, Chicago.

POWER UNITS—Gasoline, Electric
Ready Power Co., Detroit, Mich.

PREHEATERS—Air
Blaw-Knox Co., Pgh.

PRESS ATTACHMENTS
Littell, F. J., Mach. Co., Chicago.
V & O Press Co., Hudson, N. Y.

PRESSED METAL PARTS
Detroit (Mich.) Metal Specialty Corp.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia.
Bassett Corp., The, Utica, N. Y.
Detroit (Mich.) Metal Specialty Corp.
Matthews Mfg. Co., Worcester, Mass.
Metal Specialty Co., Cincinnati.
Parish Pressed Steel Co., Reading, Pa.
New England Pressed Steel Co., 1 Washington Ave., Natick, Mass.
York (Pa.) Corrugating Co.

PRESSES—Bending or Straightening
Rock River Engng. Co., Janesville, Wis.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Die
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Drop
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Standard Machinery Co., Auburn, R. I.

PRESSES—Extrusion
Robertson, John, Co., 123 Water St., Brooklyn, N. Y.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Foot
Adriance Mach. Works, Inc., 82 Richards St., Bklyn, N. Y.
Baird Machine Co., Bridgeport, Ct.
Shuster, F. B., Co., New Haven, Ct.
Taylor & Fenn Co., Hartford, Ct.

PRESSES—Forcing
Lucas Mch. Tool Co., Cleve.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Forging
Mesta Mch. Co., Pgh.
Morgan Engineering Co., Alliance, O.
Robertson, John, Co., 123 Water St., Brooklyn, N. Y.
Rock River Engng. Co., Janesville, Wis.
Southwark Fdry. & Mach. Co., Phila.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

PRESSES—Forming and Bending
Cincinnati (O.) Shaper Co., The.
Dreis & Krump Mfg. Co., Chicago.
Streine Tool & Mfg. Co., New Bremen, O.

PRESSES—Hot and Cold Plate
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Hydraulic
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Elmes, Chas. P., Engrg. Works, Chicago.
French Oil Mill Machy. Co., Piqua, O.
Lake Erie Engng. Corp., Buffalo, N. Y.
Mesta Mch. Co., Pgh.
Morgan Engineering Co., Alliance, O.
Robertson, John, Co., 123 Water St., Brooklyn, N. Y.
Rock River Engng. Co., Janesville, Wis.
Southwark Fdry. & Mach. Co., Phila.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

PRESSES—Multiple Plunger
Waterbury (Ct.) Farrel Fdry. & Mch. Co.

PRESSES—Power
Adriance Machine Works, Inc., 82 Richards St., Bklyn, N. Y.
Baird Machine Co., Bridgeport, Ct.
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co., The.
Cleveland (O.) Punch & Shear Wks. Co.
Ferracute Machine Co., Bridgeton, N. J.
Hymes, Joseph, & Sons, Phila.
Loy & Nawrath, Div. of Farrel-Birmingham Co., Inc., Derby, Conn.
Manville, E. J., Mach. Co., Waterbury, Ct.
Minster (O.) Machine Co.
Moore, J. N., Philadelphia.
New Albany (Ind.) Mch. Mfg. Co.
Niagara Machine & Tool Works, Buffalo, N. Y.
Old, George A., & Co., Inc., Newark, N. J.
Pels, Henry, & Co., 90 West St., N. Y. C.
Standard Machinery Co., Auburn, R. I.
Toledo (O.) Mach. & Tool Co.
V & O Press Co., Hudson, N. Y.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES—Roofing and Corrugating
Streine Tool & Mfg. Co., New Bremen, O.

PRESSES—Scrap Bundling
Galland-Henning Mfg. Co., Milwaukee.
Standard Machinery Co., Auburn, R. I.

PRESSES—Trimming
Erie (Pa.) Fdry. Co.
Toledo (O.) Mch. & Tool Co.

PRESSES—Wheel
Bethlehem (Pa.) Steel Co.

PROJECTORS—Contour Measuring
Bausch & Lomb Optical Co., Rochester, N. Y.

PULLEY MACHINERY
Avey Drilling Mch. Co., Cincinnati, O.

PULLEYS—Belt (Pressed Steel)
American Pulley Co., Philadelphia.

PULLEYS—Car (Electric)
Caldwell, H. W., & Son Co., Chicago.

PULLEYS—Friction Clutch
Caldwell, W. E., Co., 200 Brandels St., Louisville, Ky.
Falls Clutch & Mchy. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.

PULLEYS—Iron, Solid and Split
Caldwell, W. E., Co., 200 Brandels St., Louisville, Ky.
Falls Clutch & Mchy. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.

PULLEYS—Magnetic
Cutler-Hammer, Inc., Milwaukee.
Dings Magnetic Separator Co., Milwaukee.
Magnetic Mfg. Co., Milwaukee.

PULLEYS—Motor and Machine (Compressed Spruce)
American Pulley Co., Philadelphia.

PULLEYS—Steel, Rim Solid and Split
Hyman, Joseph, & Sons, Phila.

PULVERIZERS
American Pulverizer Co., St. Louis, Mo.
Bartlett, C. O. & Snow Co., Cleve.
Bethlehem (Pa.) Steel Co.

PULVERIZERS—Coal
Bartlett, C. O. & Snow Co., Cleve.
Bethlehem (Pa.) Steel Co.

PUMPS—Boiler Feed
Buffalo (N. Y.) Steam Pump Co., 492 B'way.
Dean Bros., Indianapolis, Ind.
Ingersoll-Rand Co. (Cameron), 11 B'way, N. Y. C.
Manistee (Mich.) Iron Works Co.
Morris Mch. Works, Baldwinsville, N. Y.

PUMPS—Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee.
Buffalo (N. Y.) Steam Pump Co., 492 B'way.
De Laval Steam Turbine Co., Trenton, N. J.
Ingersoll-Rand Co. (Cameron), 11 B'way, N. Y. C.
Manistee (Mich.) Iron Works Co.
Morris Mch. Works, Baldwinsville, N. Y.
Penna. Pump & Compressor Co., Easton, Pa.

PUMPS—Electric
Myers, F. E., & Bro. Co., Ashland, O.

PUMPS—Hand & Power
Myers, F. E., & Bro. Co., Ashland, O.

PUMPS—Hydraulic
American Field Motors Co., 2110 Arrangton Ave., Philadelphia.
Elmes, Chas. P., Engrg. Works, Chicago.
Dean Bros. Co., Indianapolis
Galland-Henning Mfg. Co., Milwaukee.
Southwark Fdry. & Mch. Co., Phila.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

PUMPS—Pneumatic Air Lift
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Sullivan Machinery Co., Chicago.

PUMPS—Steam
Buffalo (N. Y.) Steam Pump Co., 492 B'way.
Ingersoll-Rand Co. (Cameron) 11 B'way, N. Y. C.
Schultz, A. L., & Son, Chicago.

PUMPS—Vacuum
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Penna. Pump & Compressor Co., Easton, Pa.
Sullivan Machinery Co., Chicago.

PUNCHES—Pneumatic
Hanna Engineering Wks., Chicago.

PUNCHES AND DIES
Cleveland (O.) Punch & Shear Wks. Co.
Marchant, Geo. F., Co., Chicago.
Richards, I. P., Co., Providence, R. I.

PUNCHING AND SHEARING MACHINES
Beatty Mch. & Mfg. Co., Hammond, Ind.
Bertsch & Co., Cambridge City, Ind.
Buffalo (N. Y.) Forge Co., 492 B'way.
Cleveland (O.) Punch & Shear Wks. Co.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Excelsior Tool & Mch. Co., East St. Louis, Ill.
Ferracute & Whittemore Co., Beloit, Wis.
Long & Allstatter Co., Hamilton, O.
Pels, Henry, & Co., 90 West St., N. Y. C.
Quicksteck Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Ryerson, Jos. T., & Son, Inc., Chicago.
Smith, David H., & Sons, Inc., Ft. of 51st St., Brooklyn, N. Y.
Southwark Fdry. & Mch. Co., Phila.
Thomas Spacing Mach. Co., Pgh.
Whitney Metal Tool Co., Rockford, Ill.

PURIFIERS—Oil
De Laval Steam Turbine Co., Trenton, N. J.
National Acme Co., The, Cleveland.

PURIFIERS—Steam
Blaw-Knox Co., Pgh.

PYROMETERS—Controlling
Brown Instrument Co., The, Philadelphia.

PYROMETERS—Indicating
Bristol Co., Waterbury, Ct.
Brown Instrument Co., The, Philadelphia.
Hoskins Mfg. Co., Detroit.
Taylor Instrument Companies, Rochester, N. Y.
Wilson-Maeulen Co., Inc., 738 E. 143d St., N. Y. C.

PYROMETERS—Recording
Brown Instrument Co., The, Philadelphia.

PYROMETERS—Purifiers, Gas
Research Corp., 25 West 43rd St., N. Y. C.

RAIL BONDS
American Steel & Wire Co., Chicago.

RAIL SPLICE BARS
Ames, W. & Co., Jersey City, N. J.
Sweet's Steel Co., Williamsport, Pa.

RAILS
Cohen, Louis, & Son, Wilkes-Barre, Pa.
Foster, L. B., Co., Pgh.
Frank, M. K., Pittsburgh
Hyman-Michaels Co., Chicago.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago.
Lindheimer, S. W., Inc., Chicago.
Luria Bros. & Co., Inc., Woolworth Bldg., N. Y. C.
Richardson & Co., Inc., Pgh.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Witherow Steel Corp., Pittsburgh.

RAILS—Light Steel
Sweet's Steel Co., Williamsport, Pa.

RAILS—Relaying
Continental Iron & Steel Co., 33 Rector St., N. Y. C.
Foster, L. B., Co., Pgh.
Petty, Buxton, Doane Co., Boston.
Sherwood, E. C., 48 Church St., N. Y. C.
Zelnicker in St. Louis, Mo.

RAILWAY EQUIPMENT AND SUPPLIES
Columbia Mch. Works & M. I., Co., 275 Chestnut St., Bklyn, N. Y.
Foster, L. B., Co., Pgh.
Hyman-Michaels Co., Chicago.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Kantlink Mffrs., 40 Hermon St., Newark, N. J.
Lindheimer, S. W., Inc., Chicago.
Scullin Steel Co., St. Louis, Mo.
Zelnicker in St. Louis, Mo.

REAMERS—Adjustable and Expansion
Brubaker, W. L., & Bros. Co., 50 Church St., N. Y. C.
Cleveland (O.) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES
Blanchard Mch. Co., Cambridge, Mass.

REGULATORS—Compressed Gas
Harris Calorific Co., Cleveland.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

RHEOSTATS—Plating Tank
Hanson-Van Winkle-Munning Co., Matawan, N. J.

RINGS—Iron or Steel
Akron-Selle Co., Akron, Ohio.
Edgewater Steel Co., Pgh.
Heppenstall Forge & Knife Co., Pgh.
Midvale Co., The, Nicetown, Phila., Pa
Milwaukee (Wis.) Force & Mch. Co.
Vulcan Steam Forging Co., Buffalo, N. Y.

RINGS—Welded
American Welding & Mfg. Co., Warren, O.

RIVET CUTTING GUNS
Rivet Cutting Gun Co., Cinci.

RIVET MAKING MACHINERY
Acme Machinery Co., Cleve.
Manville, E. J., Mach. Co., Waterbury, Ct.
National Mchry. Co., Tiffin, Ohio.

RIVET SETS
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Cleveland (O.) Punch & Shear Wks. Co.
Marchant, Geo. F., Co., Chicago.

RIVETING MACHINES
Allen, John F., Co., 372 Gerard Ave., N. Y.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Hanna Engrg. Works, Chicago.
Shuster, F. B., Co., New Haven, Ct.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

RIVETS
Bethlehem (Pa.) Steel Co.
Clark Bros. Bolt Co., Milldale, Ct.
Hassall, John, Inc., Clay & Oakland Sts., Brooklyn, N. Y.
Lake Erie Bolt & Nut Co., The, Cleveland.
Neely Nut & Bolt Co., Pgh.
Progressive Mfg. Co., Torrington, Ct.
Reed & Prince Mfg. Co., Worcester, Mass.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., Chicago.
Wrought Iron Co. of America, Lebanon, Pa.

RODS—Aluminum
Sheet Aluminum Corp., Jackson, Mich.

RODS—Brass, Bronze, Copper or Nickel Silver
American Brass Co., Waterbury, Ct.

RODS—Nickel Silver
Seymour (Ct.) Mfg. Co.

RODS—Phosphor Bronze
American Brass Co., Waterbury, Ct.
Phosphor Bronze Smelting Co., Phila.
Seymour (Ct.) Mfg. Co.

RODS—Welding
Air Reduction Sales Co., 342 Madison Ave., N. Y. C.
American Brass Co., Waterbury, Ct.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

RODS—Welding, Manganese Steel
Manganese Steel Forge Co., Phila.

RODS—Wire
American Steel & Wire Co., Chicago.
Washburn Wire Co., Inc., Phillipsdale, R. I.
Washburn Wire Co., Inc., 118th & Harlem River, N. Y. C.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.
Youngstown (O.) Sheet & Tube Co.

ROLLING MACHINERY—Cold Rolling
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Kane & Roach, Syracuse, N. Y.
Yoder Co., The, Cleveland.

ROLLING MACHINERY—Corrugating
Streine Tool & Mfg. Co., New Bremen, O.

ROLLING MACHINERY—Sheet Leveler
Aetna-Standard Eng. Co., Youngstown, O.
Streine Tool & Mfg. Co., New Bremen, O.

ROLLING MACHINERY—Sheet Metal
Streine Tool & Mfg. Co., New Bremen, O.
Yoder Co., The, Cleveland.

ROLLING MACHINERY—Sheet Oiling
Aetna-Standard Eng. Co., Youngstown, O.
Streine Tool & Mfg. Co., New Bremen, O.

ROLLING MILL MACHINERY
Aetna-Standard Eng. Co., Youngstown, O.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Haines Gauge Co., Phila.
Hyde Park (Pa.) Fdry. & Mch. Co.
Mackintosh-Hemphill Co., Ptgh.
Mesta Mch. Co., Ptgh.
Morgan Engineering Co., Alliance, O.
National Roll & Fdry. Co., Avonmore, Pa.
Newbold, R. S., & Son Co., Norristown, Pa.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Standard Machinery Co., Auburn, R. I.
Sutton Engng. Co., Ptgh.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdry. Co., Ptgh.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.
Wellman-Seaver-Morgan Co., Cleveland.

ROLLS—Alloy Steel
Duquesne Steel Fdry. Co., Pittsburgh, Pa.
Pittsburgh (Pa.) Rolls Corp.
United Engrg. & Fdry. Co., Ptgh.

ROLLS—Bending and Straightening
Bertsch & Co., Cambridge City, Ind.
Bethlehem (Pa.) Steel Co.
Cleveland (O.) Punch & Shear Wks. Co.
Hendley & Whittemore Co., Beloit, Wis.
Lake Erie Engng. Corp., Buffalo, N. Y.
Marshalltown (Iowa) Mfg. Co.
Niagara Machine & Tool Works, Buffalo, N. Y.
Rock River Engng. Co., Janesville, Wis.
Ryerson, Jos. T., & Son, Inc., Chicago.
Southwark Foundry & Mch. Co., Phila.
Sutton Engrg. Co., Ptgh.

ROLLS—Galvanizing
Erie (Pa.) Forge Co.

ROLLS—Sand Chilled Iron and Steel
Aetna-Standard Eng. Co., Youngstown, O.
American Steel Foundries, Chicago.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park (Pa.) Fdry. & Mach. Co.
Mesta Mch. Co., Ptgh.
National Roll & Fdry. Co., Avonmore, Pa.
Pittsburgh (Pa.) Rolls Corp.
United Engng. & Fdry. Co., Pittsburgh.

ROLLS—Special Hardened
Bethlehem (Pa.) Steel Co.
Midvale Co., The, Nicetown, Phila., Pa.

ROOFING—Cement Tile
American Cement Tile Mfg. Co., 803 Oliver Bldg., Ptgh.

ROOFING—Concrete
Austin Co., The, Cleveland.

ROOFING—Special Copper Bearing Steel
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—Corrugated and Plain
American Rolling Mill Co., Middletown, Ohio.
American Sheet & Tin Plate Co., Ptgh.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Youngstown (O.) Sheet & Tube Co.

ROOFING AND SIDING—(Genuine Open Hearth Iron)
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—Iron and Steel
Newport (Ky.) Rolling Mill Co.

ROOFING & SIDING—(Zinc) Corrugated & Plain
St. Joseph Lead Co., 250 Park Ave., N. Y. C.

ROPE—Power Transmission
Allis-Chalmers Mfg. Co., Milwaukee.

RUST REMOVING
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.

RUST PREVENTIVES
American Chemical Paint Co., Ambler, Pa.
Parker Rust-Proof Co., Detroit.
Varnish Products Co., Cleveland.

RUST REMOVING
American Chemical Paint Co., Ambler, Pa.

SAFETY DEVICES AND SUPPLIES
Never Slip Safety Clamp Co., 51 East 42nd St., N. Y. C.
Weldit Acetylene Co., Detroit.

SAFETY DEVICES—Power Press
Wiesman Mfg. Co., Dayton, O.

SAND—Core
Industrial Silica Corp., Youngstown, Ohio.

SAND—Furnace Bottom
Industrial Silica Corp., Youngstown, Ohio.

SAND—Molding
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., N. Y. C.

SAND—Sand Blast
Cape May Sand Co., Cape May, N. J.
Industrial Silica Corp., Youngstown, Ohio.
Steelblast Abrasive Co., Cleveland.

SAND—Steel Molding
Cape May Sand Co., Cape May, N. J.
Industrial Silica Corp., Youngstown, Ohio.

SAND BLAST EQUIPMENT AND MACHINES
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Arcade Mfg. Co., Freeport, Ill.
Mott Sand Blast Mfg. Co., Inc., Chi.
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., Cleveland, O.

SAND CUTTING AND SCREENING MACHINES
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Bartlett, C. O. & Snow Co., Cleve.

SAND HANDLING EQUIPMENT
Bartlett, C. O. & Snow Co., Cleve.
Beardsley & Piper Co., Chicago, Ill.
Hayward Co., 50 Church St., N. Y. C.
National Engineering Co., Chicago.

SAND MILLS
Bartlett, C. O. & Snow Co., Cleve.
National Engineering Co., Chicago.

SAND RAMMERS
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.

SASH—Steel
Truscon Steel Co., Youngstown.

SAWING MACHINES—Band for Wood or Metal
Diamond Saw & Stpg. Wks., Buffalo, N. Y.

SAWING MACHINES—Metal
Atkins, E. C., & Co., Indianapolis, Ind.
Cochrane-Bly Co., Rochester, N. Y.
Earle Gear & Mch. Co., Phila.
Espen-Lucas Mach. Works, Phila.
Peerless Machine Co., Racine, Wis.
Racine Tool & Mch. Co., 1755 State St., Racine, Wis.

SAWS—Band and Hack for Metal
Armstrong-Blum Mfg. Co., Chicago.
Atkins, E. C., & Co., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., Phila.

SAWS—Circular, Rip and Cutoff
Atkins, E. C., & Co., Indianapolis, Ind.
Cochrane-Bly Co., Rochester, N. Y.

SAWS—Cold Metal
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS—Friction
Atkins, E. C., & Co., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., Chicago.

SAWS—Hack Saw Blades
Atkins, E. C., & Co., Indianapolis, Ind.
Darwin & Milner, Inc., Cleveland.
Peerless Machine Co., Racine, Wis.

SAWS—Hot Metal
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS—Inserted Tooth, Cold
Disston, Henry, & Sons, Inc., Phila.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS—Milling
Disston, Henry & Sons, Inc., Phila.

SAWS—Screw Slotting
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS—Sliding Frame
United Engrg. & Fdry. Co., Ptgh.

SCALES—Counting
National Scale Corp., Chicopee Falls, Mass.

SCRAP—Iron and Steel
Luria Bros. & Co., Inc., Woolworth Bldg., N. Y. C.
Perry, Buxton, Doane Co., Boston.
Potts, Henry, & Co., Phila.

SCREENS—Perforated Metal
Chicago Perforating Co., Chicago, Ill.
Cross Engineering Co., Carbondale, Pa.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.
Harrington & King Perforating Co., Chi.
Hendrick Mfg. Co., Carbondale, Pa.
Mundt, Chas., & Sons, Jersey City, N. J.

SCREENS—Vibrating
Link-Belt Co., Chicago

SCREENS—Woven Wire
Manganese Steel Forge Co., Phila.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Bristol, Ct.
Bell, David, Co., Inc., The, Buffalo, N. Y.
Brown Bag Filling Machine Co., The, Fitchburg, Mass.
Cleveland (O.) Cap Screw Co., The.
Corbin Screw Corp., New Britain, Ct.
Eastern Mch. Screw Corp., New Haven, Ct.
Ferry Cap & Set Screw Co., Cleveland.
Hartford (Ct.) Machine Screw Co.
Luers Bros. Mchry. & Tool Co., Detroit, Mich.
National Acme Co., The, Cleveland.
New Britain-Gridley Mch. Co., The, New Britain, Ct.
Newton Mfg. Co., Plainville, Ct.
Olson Mfg. Co., Worcester, Mass.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Penn Screw & Machine Works, Phila.
Progressive Mfg. Co., Torrington, Ct.
Screw Mch. Products Corp., Plainfield, N. J.
Shimer, Samuel J., & Sons, Inc., Milton, Pa.
Union Screw & Mfg. Co., Pittsburgh, Pa.
Western Screw Products Co., St. Louis, Mo.

SCREW MACHINERY—Automatic
Cleveland (O.) Automatic Mch. Co., The.
Cone Automatic Mach. Co., Inc., Windsor, Vt.
National Acme Co., The, Cleveland.
New Britain-Gridley Mch. Co., The, New Britain, Ct.

SCREW MACHINERY—Automatic Wood
Cook, Asa S., Co., Hartford, Ct.

SCREW MACHINERY—Hand
Jones & Lamson Mch. Co., Springfield, Vt.

SCREW MACHINERY—Multiple Spindle
Acme Mch. Tool Co., Cincinnati.
Cleveland (O.) Automatic Mch. Co., The.
Cone Automatic Mach. Co., Inc., Windsor, Vt.
National Acme Co., The, Cleveland.

SCREW MACHINERY—Semi-Automatic
Cleveland (O.) Automatic Mch. Co., The.

SCREWS—Cap
Clark Bros. Bolt Co., Milldale, Ct.
Cleveland (O.) Cap Screw Co.
Corbin Screw Corp., New Britain, Ct.
Ferry Cap & Set Screw Co., Cleveland.
National Acme Co., The, Cleveland.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Reed & Prince Mfg. Co., Worcester, Mass.
Shimer, Samuel J., & Sons, Inc., Milton, Pa.
Strong, Carlisle & Hammond Co., Cleve.
Western Screw Products Co., St. Louis, Mo.

SCREWS—Coach or Lag
Lamson & Sessions Co., The, Cleveland, O.

SCREWS—Cold Headed
Cleveland (O.) Screw Co., The.

SCREWS—Drive, Hardened Metallic
Parker-Kalon Corp., 200 Varick St., N. Y. C.

SCREWS—Machine
Corbin Screw Corp., New Britain, Ct.
Progressive Mfg. Co., Torrington, Ct.
Reed & Prince Mfg. Co., Worcester, Mass.

SCREWS—Safety Set
Allen Mfg. Co., The, Hartford, Ct.
Bristol Co., Waterbury, Ct.
Progressive Mfg. Co., Torrington, Ct.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleve.

SCREWS—Set
Ferry Cap & Set Screw Co., Cleveland.
National Acme Co., The, Cleveland.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Reed & Prince Mfg. Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleve.

SCREWS—Self-Tapping, Hardened
Parker-Kalon Corp., 200 Varick St., N. Y. C.

SCREWS—Sheet Metal, Hardened Self-Tapping
Parker-Kalon Corp., 200 Varick St., N. Y. C.

SCREWS—Socket-Head
Allen Mfg. Co., The, Hartford, Ct.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS—Thumb Malleable
Philadelphia (Pa.) Hardware & Malleable Iron Wks., Inc.

SCREWS—Wood
Corbin Screw Corp., New Britain, Ct.
Reed & Prince Mfg. Co., Worcester, Mass.

SCRUBBING MACHINES—Sheet
Wean Engng. Co., Inc., The, Warren, O.

SCYTHE STONES AND WHETSTONES
Carborundum Co., The, Niagara Falls, N. Y.

SECOND-HAND MACHINERY — See Clearing House Section
Adams, Ogden R., Rochester, N. Y.
Arnot, James P., Ptgh.
Asher Mchry. Co., Newark, N. J.
Bath, Cyril J. & Co., Cleveland.
Beatty Mch. & Mfg. Co., Hammond, Ind.
Bennett Mchry. Co., 26 Church St., New York City.
Boston Iron & Metal Co., Baltimore, Md.
Bowenik Bros., Inc., New Haven, Ct.
Brotherhood, Percy M., & Son, 25 Church St., N. Y. C.
Briggs & Turivas, Inc., Blue Island, Ill.
Eastern Mchry. Co., Cincinnati.
Ecker, E. A., Mchry. Co., Inc., Providence, R. I.
Easley, E. L., Mchry. Co., Chicago.
Fallon, N. C. Co., Inc., 30 Church St., N. Y. C.
Firm Furnishing Corp., 1 Hanover Place, Brooklyn, N. Y.
Fuoss Mchry. Co., Cleveland, Ohio.
Harris Bros. Co., Chicago.
Hill, Clarke & Co., of Chicago, 647 W. Washington Blvd., Chicago.
Idea Machinery Co., Plainville, Ct.
Indiana Mchry. Co., Fort Wayne, Ind.
Industrial Plants Corp., 27 Church St., N. Y. C.
Johnson, Wm. C., & Sons, Mchry. Co., St. Louis, Mo.
Lloewerth, Thomas J., & Co., Ptgh.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
MacCabe, T. H., Ptgh.
Marr-Gallenentz Mchry. Co., Ptgh.
Milburn, Alexander, Co., Baltimore, Md.
Miles Mchry. Co., Swanton, Vt.
S. Mich. Mchry. Co., Philadelphia.
Nixon, A. H. Mach. Co., Bridgeport, Ct.
O'Brien Machry. Co., Phila.
Oesterle & Sexton Mchry. Co., Columbus, O.
Orlatt, D. C., & Co., Cleveland.
Pettler, P., & Son, Beaver Falls, Pa.
Randle Mchry. Co., 1772 Powers St., Cincinnati.
Reliance Mchry. Sales Co., Ptgh.
Riverside Mchry. Depot, Detroit.
Ross Power Equip. Co., Indianapolis.
Russell Mch. Co., Ptgh.
Sherman, Jos. T. & Son, Inc., Chicago.
Smith-Jones & Co., Chicago.
Simmons Mach. Tool Corp., Albany, N. Y.
Smith, H. A., Mchry. Co., Syracuse, N. Y.
Sun Mchry. Co., Inc., Newark, N. J.
Wayne Co., Fort Wayne, Ind.
Weiss, E. M., Philadelphia.
White, A. D. Machry. Co., Chicago.

SEPARATORS—Gas
Research Corp., 25 West 43rd St., N. Y. C.

SEPARATORS—Magnetic
Dings Magnetic Separator Co., Milwaukee
Magnetic Mfg. Co., Milwaukee.
Ohio Electric & Controller Co., Cleve.

SEPARATORS—Oil
Ransohoff, N., Inc., Cinn., Ohio.

SHAFTING—Cold Drawn
Bethlehem (Pa.) Steel Co.
Bliss & Laughlin, Inc., Harvey, Ill.
Cumberland (Md.) Steel Co.
Ryerson, Jos. T. & Son, Inc., Chicago.
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Ptgh.

SHAFTING—Smooth Forged or Rough Turned
Erie (Pa.) Forge Co.

SHAFTING—Steel
Bliss & Laughlin, Inc., Harvey, Ill.
Cumberland (Md.) Steel Co.

SHAFTING—Turned and Polished
Cumberland (Md.) Steel Co.
Jones & Laughlin Steel Corp., Ptgh.
Moltrum Steel Products Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Ptgh.

SHAPES—Agricultural
Port Pitt Steel Casting Co., McKeesport, Pa.

SHAFTS—Flanged, Upset Forged
Amer. Forge Co., 2621 S. Hoyne Ave., Chicago.

SHAPES—Cold Drawn
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Pittsburgh.

SHAPES—Cold Rolled
Britesun, Inc., Chicago.

SHAPES—Steel
Phoenix Iron Co., Phila.
Ryerson, Jos. T., & Son, Inc., Chicago.

SHAPES—Wire
Titchener, E. H., & Co., Binghamton, N. Y.

SHAPING MACHINES—Horizontal
American Tool Works Co., Cinci.
Cincinnati (O.) Shaper Co., The.
Crescent Machine Co., Leetonia, O.
Gould & Eberhardt, Newark, N. J.
Hendey Mch. Co., Torrington, Ct.
Ryerson, Jos. T., & Son, Inc., Chicago
Smith & Mills Co., Cinci.

SHEAR BLADES AND KNIVES
Atkins, E. C., & Co., Indianapolis, Ind.
Hepenstall Forge & Knife Co., Ptgh.
Marshalltown (Iowa) Mfg. Co.
Pittsburgh Forgings Co., Coraopolis, Pa.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Yoder Co., The, Cleveland.

SHEARING MACHINES—Alligator
Canton (O.) Fdry. & Mch. Co.
Chamberlain & Kirsten, 2165 Chambers St., Mil.
Hendley & Whittemore Co., Beloit, Wis.
Long & Allstatter Co., Hamilton, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Pels, Henry, & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Foot of 51st St., Brklyn, N. Y.
United Engrg. & Fdry. Co., Ptgh.

SHEARING MACHINES—Angle, Hand and Power
Cleveland (O.) Punch & Shear Wks. Co.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Pels, Henry, & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Foot of 51st St., Brklyn, N. Y.
Thomas Spacing Mach. Co., Ptgh., Pa.

PIPE COVERING—Asbestos
Johns-Manville Corp., 292 Madison Ave., N. Y. C.

PIPE COVERING—Cork
Armstrong Cork & Insulation Co., Lancaster, Pa.

PIPE CUTTING MACHINES
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
Newbold, R. S., & Son Co., Norristown, Pa.

PIPE CUTTING AND THREADING MACHINES
Aetna-Standard Eng. Co., Youngstown, O.
Bignall & Keeler Mch. Wks., Edwardsville, Ill.
Curtis & Curtis Co., 327 Garden St., Bridgeport, Ct.
Jarecki Mfg. Co., Erie, Pa.
Landis Mach. Co., Inc., Waynesboro, Pa.
Murchey Mach. & Tool Co., 951 Porter St., Detroit.
Pipe Machy. Co., The, Cleve.
Saunders, D., Sons, Yonkers, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Williams Tool Corp., Erie, Pa.

PIPE FITTINGS
Kellogg, M. W., Co., The, 225 Bdway, N. Y. C.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Jarecki Mfg. Co., Erie, Pa.

PISTON & PISTON RING MACHINES
Cleveland (O.) Automatic Mch. Co., The.

PISTON RODS
Heppenstall Forge & Knife Co., Pgh

PLANING MACHINES—Metal
American Tool Works Co., Cincl.
Cincinnati (O.) Planer Co., The.
Cleveland (O.) Planer Co., The.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Gray, G. A., Co., Cincl.
Liberty Mch. Tool Co., Hamilton, O.
Manning, Maxwell & Moore, Inc., 100 E. 42nd St., N. Y. C.
Ryerson, Jos. T., & Son, Inc., Chicago.
Sellers, William, & Co., Inc., Phila.

PLANING MACHINES—Open Side
Cincinnati (O.) Planer Co., The.
Cleveland (O.) Planer Co., The.
Gray, G. A., Co., Cincl.
Liberty Mch. Tool Co., Hamilton, O.

PLANING MACHINES—Second Hand
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
Miles Mchry. Co., Saginaw, W. S., Mich.

PLANTS FOR SALE
Rockaway (N. J.) Rolling Mill, The.

PLATERS' CLEANING COMPOUND
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., 22 Thames St., N. Y.

PLATES—Cellar Door or Floor
Alan Wood Steel Co., Conshohocken, Pa.
American Pressed Steel Co., Phila.
Carnegie Steel Co., Pgh.
Central Iron & Steel Co., Harrisburg, Pa.

PLATES—Felloe
Wrought Washer Mfg. Co., Milwaukee.

PLATES—Iron or Steel
Alan Wood Steel Co., Conshohocken, Pa.
American Pressed Steel Co., Philadelphia.
American Rolling Mill Co., Middletown, Ohio.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Central Iron & Steel Co., Harrisburg, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pgh.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Tennessee Coal, Iron & Railroad Co. Birmingham, Ala.
Youngstown (O.) Sheet & Tube Co.

PLATES—Manganese Steel
Manganese Steel Forge Co., Phila.

PLATFORMS—Lift Truck
Lewis-Shepard Co., 122 Walnut St. Watertown Station, Boston.

PLATING EQUIPMENT—Automatic
Hanson-Van Winkle-Munning Co., Matawan, N. J.

PLUGS—Core Hole
Hubbard, M. D., Spring Co., Pontiac, Mich.

PLUMBING FIXTURES—Brass
Enterprise Brass Works, Muskegon Heights, Mich.

POINTING & THREADING MACHINERY
Economy Engng. Co., The, Willoughby, O.

POLISHING & BUFFING MACHINES
Divine Brothers Co., Utica, N. Y.
Hammond Mchry. Builders, Inc., Formerly Hill-Curtis Co., Kalamazoo, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

POLISHING MACHINES—Belt
Production Mch. Co., Greenfield, Mass.

POLISHING WHEELS
Divine Brothers Co., Utica, N. Y.
Hanson-Van Winkle-Munning Co., Matawan, N. J.

POSTS—Steel Fence
American Steel & Wire Co., Chicago.

POWDERED COAL EQUIPMENT—See Pulverized Coal Equipment

POTENTIOMETERS
Brown Instrument Co., The, Philadelphia.

POWER TRANSMITTING MACHINERY
American Pulley Co., Philadelphia
Caldwell, H. W., & Son Co., Chicago.
Falk Corp., Milwaukee.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co. 4434 W. Roosevelt Road, Chicago.
Schultz, A. L., & Son, Chicago.

POWER UNITS—Gasoline, Electric
Ready Power Co., Detroit, Mich.

PREHEATERS—Air
Blaw-Knox Co., Pgh.

PRESS ATTACHMENTS
Littell, F. J., Mach. Co., Chicago.
V & O Press Co., Hudson, N. Y.

PRESSED METAL PARTS
Detroit (Mich.) Metal Specialty Corp.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia
Bossert Corp., The, Utica, N. Y.
Detroit (Mich.) Metal Specialty Corp.
Matthews Mfg. Co., Worcester, Mass.
Metal Specialty Co., Cincinnati
Parish Pressed Steel Co., Reading, Pa
New England Pressed Steel Co., 1 Washington Ave., Natick, Mass.
York (Pa.) Corrugating Co.

PRESSES—Bending or Straightening
Rock River Engng. Co., Janesville, Wis.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Die
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Drop
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Standard Machinery Co., Auburn, R. I.

PRESSES—Extrusion
Robertson, John, Co., 123 Water St., Brooklyn, N. Y.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Foot
Adriance Mach. Works, Inc., 82 Richards St., Bklyn, N. Y.
Baird Machine Co., Bridgeport, Ct.
Shuster, F. B., Co., New Haven, Ct.
Taylor & Fenn Co., Hartford, Ct.

PRESSES—Forcing
Lucas Mch. Tool Co., Cleve.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Forging
Mesta Mch. Co., Pgh.
Morgan Engineering Co., Alliance, O.
United Engineering & Fdry. Co., Pgh.
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Forming and Bending
Cincinnati (O.) Shaper Co., The.
Dreis & Krump Mfg. Co., Chicago.
Streine Tool & Mfg. Co., New Bremen, O.

PRESSES—Hot and Cold Plate
Watson-Stillman Co., 71 West St., N. Y.

PRESSES—Hydraulic
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Elmes, Chas. F., Engrg. Works, Chicago.
French Oil Mill Machry. Co., Piqua, O.
Lake Erie Engng. Corp., Buffalo, N. Y.
Mesta Mch. Co., Pgh.
Morgan Engineering Co., Alliance, O.
Robertson, John, Co., 123 Water St. Brooklyn, N. Y.
Rock River Engng. Co., Janesville, Wis.
Southwark Fdry. & Mach. Co., Phila.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

PRESSES—Multiple Plunger
Waterbury (Ct.) Farrel Fdry. & Mch. Co.

PRESSES—Power
Adriance Machine Works, Inc., 82 Richards St., Bklyn, N. Y.
Baird Machine Co., Bridgeport, Ct.
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co., The.
Cleveland (O.) Punch & Shear Wks. Co.
Ferracute Machine Co., Bridgeton, N. J.
Hyman, Joseph, & Sons, Phila.
Loy & Nawrath, Div. of Farrel-Birmingham Co., Inc., Derby, Conn.
Manville, E. J., Mach. Co., Waterbury, Ct.
Minster (O.) Machine Co.
Moyer, J. N., Philadelphia.
New Albany (Ind.) Mch. Mfg. Co.
Niagara Machine & Tool Works, Buffalo, N. Y.
Obl, George A., & Co., Inc., Newark, N. J.
Pels, Henry, & Co., 90 West St., N. Y. C.
Standard Machinery Co., Auburn, R. I.
Toledo (O.) Mach. & Tool Co.
V & O Press Co., Hudson, N. Y.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES—Riveting and Corrugating
Streine Tool & Mfg. Co., New Bremen, O.

PRESSES—Scrap Bundling
Galland-Henning Mfg. Co., Milwaukee.
Standard Machinery Co., Auburn, R. I.

PRESSES—Trimming
Erie (Pa.) Fdry. Co.
Toledo (O.) Mch. & Tool Co.

PRESSES—Wheel
Bethlehem (Pa.) Steel Co.

PROJECTORS—Contour Measuring
Bausch & Lomb Optical Co., Rochester, N. Y.

PULLEY MACHINERY
Avey Drilling Mch. Co., Cincinnati, O.

PULLEYS—Belt (Pressed Steel)
American Pulley Co., Philadelphia

PULLEYS—Car (Electric)
Caldwell, H. W., & Son Co., Chicago.

PULLEYS—Friction Clutch
Caldwell, W. E., Co., 260 Brandeis St., Louisville, Ky.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.

PULLEYS—Iron, Solid and Split
Caldwell, W. E., Co., 260 Brandeis St., Louisville, Ky.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.

PULLEYS—Magnetic
Cutler-Hammer, Inc., Milwaukee.
Dings Magnetic Separator Co., Milwaukee.
Magnetic Mfg. Co., Milwaukee.

PULLEYS—Motor and Machine (Compressed Spruce)
American Pulley Co., Philadelphia.

PULLEYS—Steel, Rim Solid and Split
Hyman, Joseph, & Sons, Phila.

PULVERIZERS
American Pulverizer Co., St. Louis, Mo.
Bartlett, C. O. & Snow Co., Cleve.
Bethlehem (Pa.) Steel Co.

PULVERIZERS—Coal
Bartlett, C. O. & Snow Co., Cleve.
Bethlehem (Pa.) Steel Co.

PUMPS—Boiler Feed
Buffalo (N. Y.) Steam Pump Co., 493 B'way.
Dean Bros., Indianapolis, Ind.
Ingersoll-Rand Co. (Cameron), 11 B'way, N. Y. C.
Manistee (Mich.) Iron Works Co.
Morris Mch. Works, Baldwinsville, N. Y.

PUMPS—Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee.
Buffalo (N. Y.) Steam Pump Co., 493 B'way.
De Laval Steam Turbine Co., Trenton, N. J.
Ingersoll-Rand Co. (Cameron), 11 B'way, N. Y. C.
Manistee (Mich.) Iron Works Co.
Morris Mach. Works, Baldwinsville, N. Y.
Penna. Pump & Compressor Co., Easton, Pa.

PUMPS—Electric
Myers, F. E., & Bro. Co., Ashland, O.

PUMPS—Hand & Power
Myers, F. E., & Bro. Co., Ashland, O.

PUMPS—Hydraulic
American Fluid Motors Co., 2410 Aramingo Ave., Philadelphia.
Elmes, Chas. F., Engrg. Works, Chicago.
Dean Bros. Co., Indianapolis
Galland-Henning Mfg. Co., Milwaukee.
Southwark Fdry. & Mch. Co., Phila.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

PUMPS—Pneumatic Air Lift
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Sullivan Machinery Co., Chicago.

PUMPS—Steam
Buffalo (N. Y.) Steam Pump Co., 493 B'way.
Ingersoll-Rand Co. (Cameron) 11 B'way, N. Y. C.
Schultz, A. L., & Son, Chicago.

PUMPS—Vacuum
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.
Penna Pump & Compressor Co., Easton, Pa.
Sullivan Machinery Co., Chicago.

PUNCHES—Pneumatic
Hanna Engineering Wks. Chicago.

PUNCHES AND DIES
Cleveland (O.) Punch & Shear Wks. Co.
Marchant, Geo. F., Co., Chicago.
Richards, I. P., Co., Providence, R. I.

PUNCHING AND SHEARING MACHINES
Beatty Mch. & Mfg. Co., Hammond, Ind.
Berlsch & Co., Cambridge City, Ind.
Buffalo (N. Y.) Forge Co., 492 B'way.
Cleveland (O.) Punch & Shear Wks. Co.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Excelsior Tool & Mch. Co., East St. Louis, Ill.
Greenlee & Whittemore Co., Beloit, Wis.
Long & Allstatter Co., Hamilton, O.
Pels, Henry, & Co., 90 West St., N. Y. C.
Quicksteck Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Ryerson, Jos. T., & Son, Inc., Chicago.
Smith, David H., & Sons, Inc., Ft. of 51st St., Brooklyn, N. Y.
Southwark Fdry. & Mch. Co., Phila.
Thomas Spacing Mach. Co., Pgh.
Whitney Metal Tool Co., Rockford, Ill.

PURIFIERS—Oil
De Laval Steam Turbine Co., Trenton, N. J.
National Acme Co., The, Cleveland.

PURIFIERS—Steam
Blaw-Knox Co., Pgh.

PYROMETERS—Controlling
Brown Instrument Co., The, Philadelphia.

PYROMETERS—Indicating
Bristol Co., Waterbury, Ct.
Brown Instrument Co., The, Philadelphia.
Hoskins Mfg. Co., Detroit.
Taylor Instrument Companies, Rochester, N. Y.
Wilson-Maeulen Co., Inc., 738 E. 143d St., N. Y. C.

PYROMETERS—Recording
Brown Instrument Co., The, Philadelphia.

PYROMETERS—Purifiers, Gas
Research Corp., 25 West 43rd St., N. Y. C.

RAIL BONDS
American Steel & Wire Co., Chicago.

RAIL SPLICE BARS
Ames, W. A. & Co., Jersey City, N. J.
Sweet's Steel Co., Williamsport, Pa.

RAILS
Cohen, Louis, & Son, Wilkes-Barre, Pa.
Foster, L. B., Co., Pgh.
Frank, M. K., Pittsburgh
Hyman-Michaels Co., Chicago.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago.
Lindheimer, S. W., Inc., Chicago.
Luria Bros. & Co., Inc., Woolworth Bldg., N. Y. C.
Richardson & Co., Inc., Pgh.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Witherow Steel Corp., Pittsburgh.

RAILS—Light Steel
Sweet's Steel Co., Williamsport, Pa.

RAILS—Relaying
Continental Iron & Steel Co., 33 Rector St., N. Y. C.
Foster, L. B., Co., Pgh.
Perry, Buxton, Doane Co., Boston.
Sherwood, E. C., 48 Church St., N. Y. C.
Zelnicker, in St. Louis, Mo.

RAILWAY EQUIPMENT AND SUPPLIES
Columbia Mch. Works & M. I., Co., 275 Chestnut St., Bklyn, N. Y.
Foster, L. B., Co., Pgh.
Hyman-Michaels Co., Chicago.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Kantlink Mfrs., 40 Hermon St., Newark, N. J.
Lindheimer, S. W., Inc., Chicago.
Scullin Steel Co., St. Louis, Mo.
Zelnicker in St. Louis, Mo.

REAMERS—Adjustable and Expansion
Brubaker, W. L., & Bros. Co., 50 Church St., N. Y. C.
Cleveland (O.) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES
Blanchard Mch. Co., Cambridge, Mass.

REGULATORS—Compressed Gas
Harris Calorific Co., Cleveland.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

RHEOSTATS—Plating Tank
Hanson-Van Winkle-Munning Co., Matawan, N. J.

RINGS—Iron or Steel
Akron-Selle Co., Akron, Ohio.
Edgewater Steel Co., Pgh.
Heppenstall Forge & Knife Co., Pgh.
Midvale Co., The, Nicetown, Phila., Pa
Milwaukee (Wis.) Forge & Mch. Co.
Vulcan Steam Forging Co., Buffalo, N. Y.

RINGS—Welded
American Welding & Mfg. Co., Warren, O.

RIVET CUTTING GUNS
Rivet Cutting Gun Co., Cincl.

RIVET MAKING MACHINERY
Acme Machinery Co., Cleve.
Manville, E. J., Mach Co., Waterbury, Ct.
National Mchry. Co., Tiffin, Ohio.

RIVET SETS
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Cleveland (O.) Punch & Shear Wks. Co.
Marchant, Geo. F., Co., Chicago.

RIVETING MACHINES
Allen, John F., Co., 372 Gerard Ave., N. Y.
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Hanna Engrg. Works, Chicago.
Shuster, F. B., Co., New Haven, Ct.
Watson-Stillman Co., 71 West St., N. Y.
Wood, R. D., & Co., Philadelphia.

RIVETS
Bethlehem (Pa.) Steel Co.
Clark Bros. Bolt Co., Millbiale, Ct.
Hassall, John, Inc., Clay & Oakland Sts., Brooklyn, N. Y.
Lake Erie Bolt & Nut Co., The, Cleveland
Neely Nut & Bolt Co., Pgh.
Progressive Mfg. Co., Torrington, Ct.
Reed & Prince Mfg. Co., Worcester, Mass.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., Chicago
Wrought Iron Co. of America, Lebanon, Pa.

RODS—Aluminum
Sheet Aluminum Corp., Jackson, Mich.

RODS—Brass, Bronze, Copper or Nickel Silver
American Brass Co., Waterbury, Ct.

RODS—Nickel Silver
Seymour (Ct.) Mfg. Co.

RODS—Phosphor Bronze
American Brass Co., Waterbury, Ct.
Phosphor Bronze Smelting Co., Phila.
Seymour (Ct.) Mfg. Co.

RODS—Welding
Air Reduction Sales Co., 342 Madison Ave., N. Y. C.
American Brass Co., Waterbury, Ct.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

RODS—Welding, Manganese Steel
Manganese Steel Forge Co., Phila.

RODS—Wire
American Steel & Wire Co., Chicago.
Washburn Wire Co., Inc., Phillipsdale, R. I.
Washburn Wire Co., Inc., 118th & Harlem River, N. Y. C.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.
Youngstown (O.) Sheet & Tube Co.

ROLLING MACHINERY—Cold Rolling
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Kane & Roach, Syracuse, N. Y.
Yoder Co., The, Cleveland.

ROLLING MACHINERY—Corrugating
Streine Tool & Mfg. Co., New Bremen, O.

ROLLING MACHINERY—Sheet Leveler
Aetna-Standard Eng. Co., Youngstown, O.
Streine Tool & Mfg. Co., New Bremen, O.

ROLLING MACHINERY—Sheet Metal
Streine Tool & Mfg. Co., New Bremen, O.
Yoder Co., The, Cleveland.

ROLLING MACHINERY—Sheet Oiling
Aetna-Standard Eng. Co., Youngstown, O.
Streine Tool & Mfg. Co., New Bremen, O.

ROLLING MILL MACHINERY
Aetna-Standard Eng. Co., Youngstown, O.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Haines Gauge Co., Phila.
Hyde Park (Pa.) Fdry. & Mch. Co.
Mackintosh-Hemphill Co., Ptgh.
Mesta Mch. Co., Ptgh.
Morgan Engineering Co., Alliance, O.
National Roll & Fdry. Co., Avonmore, Pa.
Newbold, R. S., & Son Co., Norristown, Pa.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Standard Machinery Co., Auburn, R. I.
Sutton Engng. Co., Ptgh.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdry. Co., Ptgh.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.
Wellman-Seaver-Morgan Co., Cleveland.

ROLLS—Alloy Steel
Duquesne Steel Fdry. Co., Pittsburgh, Pa.
Pittsburgh (Pa.) Rolls Corp.
United Engrg. & Fdry. Co., Ptgh.

ROLLS—Bending and Straightening
Bertsch & Co., Cambridge City, Ind.
Bethlehem (Pa.) Steel Co.
Cleveland (O.) Punch & Shear Wks. Co.
Hendley & Whittemore Co., Beloit, Wis.
Lake Erie Engng. Corp., Buffalo, N. Y.
Marshalltown (Iowa) Mfg. Co.
Niagara Machine & Tool Works, Buffalo, N. Y.
Rock River Engng. Co., Janesville, Wis.
Ryerson, Jos. T., & Son, Inc., Chicago.
Southwark Foundry & Mch. Co., Phila.
Sutton Engrg. Co., Ptgh.

ROLLS—Galvanizing
Erie (Pa.) Forge Co.

ROLLS—Sand Chilled Iron and Steel
Aetna-Standard Eng. Co., Youngstown, O.
American Steel Foundries, Chicago.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park (Pa.) Fdry. & Mach. Co.
Mesta Mch. Co., Ptgh.
National Roll & Fdry. Co., Avonmore, Pa.
Pittsburgh (Pa.) Rolls Corp.
United Engng. & Fdry. Co., Pittsburgh.

ROLLS—Special Hardened
Bethlehem (Pa.) Steel Co.
Midvale Co., The, Nicetown, Phila., Pa.

ROOFING—Cement Tile
American Cement Tile Mfg. Co., 803 Oliver Bldg., Ptgh.

ROOFING—Concrete
Austin Co., The, Cleveland.

ROOFING—Special Copper Bearing Steel
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—Corrugated and Plain
American Rolling Mill Co., Middletown, Ohio.
American Sheet & Tin Plate Co., Ptgh.
Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Youngstown (O.) Sheet & Tube Co.

ROOFING AND SIDING—(Genuine Open Hearth Iron)
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—Iron and Steel
Newport (Ky.) Rolling Mill Co.

ROOFING & SIDING—(Zinc) Corrugated & Plain
St. Joseph Lead Co., 250 Park Ave., N. Y. C.

ROPE—Power Transmission
Allis-Chalmers Mfg. Co., Milwaukee.

RUST REMOVING
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.

RUST PREVENTIVES
American Chemical Paint Co., Ambler, Pa.
Parker Rust-Proof Co., Detroit.
Varnish Products Co., Cleveland.

RUST REMOVING
American Chemical Paint Co., Ambler, Pa.

SAFETY DEVICES AND SUPPLIES
Never Slip Safety Clamp Co., 51 East 42nd St., N. Y. C.
Weldit Acetylene Co., Detroit.

SAFETY DEVICES—Power Press
Wiesman Mfg. Co., Dayton, O.

SAND—Core
Industrial Silica Corp., Youngstown, Ohio.

SAND—Furnace Bottom
Industrial Silica Corp., Youngstown, Ohio.

SAND—Molding
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., N. Y. C.

SAND—Sand Blast
Cape May Sand Co., Cape May, N. J.
Industrial Silica Corp., Youngstown, Ohio.
Steelblast Abrasives Co., Cleveland.

SAND—Steel Molding
Cape May Sand Co., Cape May, N. J.
Industrial Silica Corp., Youngstown, Ohio.

SAND BLAST EQUIPMENT AND MACHINES
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Arcade Mfg. Co., Freeport, Ill.
Mott Sand Blast Mfg. Co., Inc., Chi.
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., Cleveland, O.

SAND CUTTING AND SCREENING MACHINES
Amer. Fdry. Equip. Co., Mishawaka, Ind.
Bartlett, C. O. & Snow Co., Cleve.

SAND HANDLING EQUIPMENT
Bartlett, C. O. & Snow Co., Cleve.
Beardsley & Piper Co., Chicago, Ill.
Hayward Co., 50 Church St., N. Y. C.
National Engineering Co., Chicago.

SAND MILLS
Bartlett, C. O. & Snow Co., Cleve.
National Engineering Co., Chicago.

SAND RAMMERS
Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.
Ingersoll-Rand Co., 11 B'way, N. Y. C.

SASH—Steel
Truscon Steel Co., Youngstown.

SAWING MACHINES—Band for Wood or Metal
Diamond Saw & Stpg. Wks., Buffalo, N. Y.

SAWING MACHINES—Metal
Atkins, E. C., & Co., Indianapolis, Ind.
Cochrane-Bly Co., Rochester, N. Y.
Earle Gear & Mch. Co., Phila.
Espen-Lucas Mach. Works, Phila.
Peerless Machine Co., Racine, Wis.
Racine Tool & Mch. Co., 1755 State St., Racine, Wis.

SAWS—Band and Hack for Metal
Armstrong-Blum Mfg. Co., Chicago.
Atkins, E. C., & Co., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., Phila.

SAWS—Circular, Rip and Cutoff
Atkins, E. C., & Co., Indianapolis, Ind.
Cochrane-Bly Co., Rochester, N. Y.

SAWS—Cold Metal
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS—Friction
Atkins, E. C., & Co., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., Chicago.

SAWS—Hack Saw Blades
Atkins, E. C., & Co., Indianapolis, Ind.
Darwin & Milner, Inc., Cleveland.
Peerless Machine Co., Racine, Wis.

SAWS—Hot Metal
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS—Inserted Tooth, Cold
Disston, Henry, & Sons, Inc., Phila.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS—Milling
Disston, Henry & Sons, Inc., Phila.

SAWS—Screw Slotting
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS—Sliding Frame
United Engrg. & Fdry. Co., Ptgh.

SCALES—Counting
National Scale Corp., Chicopee Falls, Mass.

SCRAP—Iron and Steel
Luria Bros. & Co., Inc., Woolworth Bldg., N. Y. C.
Perry, Buxton, Doane Co., Boston.
Potts, Henry, & Co., Phila.

SCREENS—Perforated Metal
Chicago Perforating Co., Chicago, Ill.
Cross Engineering Co., Carbondale, Pa.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.
Harrington & King Perforating Co., Chi.
Hendrick Mfg. Co., Carbondale, Pa.
Mundt, Chas., & Sons, Jersey City, N. J.

SCREENS—Vibrating
Link-Belt Co., Chicago

SCREENS—Woven Wire
Manganese Steel Forge Co., Phila.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Bristol, Ct.
Bell, David, Co., Inc., The, Buffalo, N. Y.
Brown Bag Filling Machine Co., The, Fitchburg, Mass.
Cleveland (O.) Cap Screw Co., The.
Corbin Screw Corp., New Britain, Ct.
Eastern Mch. Screw Corp., New Haven, Ct.
Ferry Cap & Set Screw Co., Cleveland.
Hartford (Ct.) Machine Screw Co.
Luers Bros. Mchry. & Tool Co., Detroit, Mich.
National Acme Co., The, Cleveland.
New Britain-Gridley Mch. Co., The, New Britain, Ct.
Newton Mfg Co, Plainville, Ct.
Olson Mfg. Co., Worcester, Mass.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Penn Screw & Machine Works, Phila.
Progressive Mfg. Co., Torrington, Ct.
Screw Mch. Products Corp., Prov., R. I.
Shimer, Samuel J., & Sons, Inc., Milton, Pa.
Union Screw & Mfg. Co., Pittsburgh, Pa.
Western Screw Products Co., St. Louis, Mo.

SCREW MACHINERY—Automatic
Cleveland (O.) Automatic Mch. Co., The.
Cone Automatic Mach. Co., Inc., Windsor, Vt.
National Acme Co., The, Cleveland.
New Britain-Gridley Mch. Co., The, New Britain, Ct.

SCREW MACHINERY—Automatic Wood
Cook, Asa S., Co., Hartford, Ct.

SCREW MACHINERY—Hand
Jones & Lamson Mch. Co., Springfield, Vt.

SCREW MACHINERY—Multiple Spindle
Acme Mch. Tool Co., Cincinnati.
Cleveland (O.) Automatic Mch. Co., The.
Cone Automatic Mach. Co., Inc., Windsor, Vt.
National Acme Co., The, Cleveland.

SCREW MACHINERY—Semi-Automatic
Cleveland (O.) Automatic Mch. Co., The.

SCREWS—Cap
Clark Bros. Bolt Co., Milldale, Ct.
Cleveland (O.) Cap Screw Co.
Corbin Screw Corp., New Britain, Ct.
Ferry Cap & Set Screw Co., Cleveland.
National Acme Co., The, Cleveland.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Reed & Prince Mfg. Co., Worcester, Mass.
Shimer, Samuel J., & Sons, Inc., Milton, Pa.
Strong, Carlisle & Hammond Co., Cleve.
Western Screw Products Co., St. Louis, Mo.

SCREWS—Coach or Lag
Lamson & Sessions Co., The, Cleveland, O.

SCREWS—Cold Headed
Cleveland (O.) Screw Co., The.

SCREWS—Drive, Hardened Metallic
Parker-Kalon Corp., 200 Varick St., N. Y. C.

SCREWS—Machine
Corbin Screw Corp., New Britain, Ct.
Progressive Mfg. Co., Torrington, Ct.
Reed & Prince Mfg. Co., Worcester, Mass.

SCREWS—Safety Set
Allen Mfg. Co., The, Hartford, Ct.
Bristol Co., Waterbury, Ct.
Progressive Mfg. Co., Torrington, Ct.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleve.

SCREWS—Set
Ferry Cap & Set Screw Co., Cleveland.
National Acme Co., The, Cleveland.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Reed & Prince Mfg. Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleve.

SCREWS—Self-Tapping, Hardened
Parker-Kalon Corp., 200 Varick St., N. Y. C.

SCREWS—Sheet Metal, Hardened Self-Tapping
Parker-Kalon Corp., 200 Varick St., N. Y. C.

SCREWS—Socket-Head
Allen Mfg. Co., The, Hartford, Ct.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS—Thumb Malleable
Philadelphia (Pa.) Hardware & Malleable Iron Wks., Inc.

SCREWS—Wood
Corbin Screw Corp., New Britain, Ct.
Reed & Prince Mfg. Co., Worcester, Mass.

SCRUBBING MACHINES—Sheet
Wean Engng. Co., Inc., The, Warren, O.

SCYTHE STONES AND WHETSTONES
Carborundum Co., The, Niagara Falls, N. Y.

SECOND-HAND MACHINERY — See Clearing House Section
Adams, Ogden R., Rochester, N. Y.
Arnold, James P., Ptgh.
Asher Mchry. Co., Newark, N. J.
Bath, Cyril J. & Co., Cleveland.
Beatty Mch. & Mfg. Co., Hammond, Ind.
Bennett Mchry. Co., 30 Church St., New York City.
Boston Iron & Metal Co., Baltimore, Md.
Botwinik Bros., Inc., New Haven, Ct.
Brotherhood, Percy M., & Son, 25 Church St., N. Y. C.
Briggs & Turivas, Inc., Blue Island, Ill.
Eastern Mchry. Co., Cincinnati.
Eddy, E. A., Mchry. Co., Inc., Providence, R. I.
Essley, E. L., Mchry. Co., Chicago.
Fallor, N. C. Co., Inc., 30 Church St., N. Y. C.
Firm Purchasing Corp., 1 Hanson Place, Brooklyn, N. Y.
Foster Mchry. Co., Cleveland, Ohio.
Harris Bros. Co., Chicago.
Hill, Clarke & Co. of Chicago, 647 W. Washington Blvd.
Ideal Machinery Co., Plainville, Ct.
Indiana Mchry. Co., Fort Wayne, Ind.
Industrial Plants Corp., 25 Church St., N. Y. C.
Johnson, Wm. C., & Sons, Mchry. Co., St. Louis, Mo.
Llewelyn, Thomas J., & Co., Ptgh.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Lucas, J. L., & Sons, Inc., Bridgeport, Ct.
MacCabe, T. B., Phila.
Marr-Galbreath Mchry. Co., Ptgh.
Milburn, Alexander, Co., Baltimore, Md.
Miles Mchry. Co., Saginaw, W. S., Mich.
Moyer, J. N., Philadelphia.
Nilson, A. H., Mach. Co., Bridgeport, Ct.
O'Brien Machry. Co., Phila.
Osborne & Sexton Mchry. Co., Columbus, O.
Oviatt, D. C., & Co., Cleveland.
Pettler, P., & Son, Beaver Falls, Pa.
Randle Mchry. Co., 1772 Powers St., Cinn.
Reliance Mchry. Sales Co., Ptgh.
Riverside Mchry. Depot, Detroit.
Ross Power Equip. Co., Indianapolis.
Russell Mch. Co., Ptgh.
Ryerson, Jos. T., & Son, Inc., Chicago.
Scully-Jones & Co., Chicago.
Simmons Mach. Tool Corp., Albany, N. Y.
Smith, H. A., Mchry. Co., Syracuse, N. Y.
Sun Mchry. Co., Inc., Newark, N. J.
Wayne Co., Fort Wayne, Ind.
Weiss, B. M., Philadelphia.
White, A. D. Machry. Co., Chicago.

SEPARATORS—Gas
Research Corp., 25 West 43rd St., N. Y. C.

SEPARATORS—Magnetic
Dings Magnetic Separator Co., Milwaukee.
Magnetic Mfg. Co., Milwaukee.
Ohio Electric & Controller Co., Cleve.

SEPARATORS—Oil
Ransohoff, N., Inc., Cinn., Ohio.

SHAFTING—Cold Drawn
Bethlehem (Pa.) Steel Co.
Bliss & Loughlin, Inc., Harvey, Ill.
Cumberland (Md.) Steel Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Ptgh.

SHAFTING—Smooth Forged or Rough Turned
Erie (Pa.) Forge Co.

SHAFTING—Steel
Bliss & Laughlin, Inc., Harvey, Ill.
Cumberland (Md.) Steel Co.

SHAFTING—Turned and Polished
Cumberland (Md.) Steel Co.
Jones & Laughlin Steel Corp., Ptgh.
Moltrup Steel Products Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Ptgh.

SHAPES—Agricultural
Fort Pitt Steel Casting Co., McKeesport, Pa.

SHAFTS—Flanged, Upset Forged
Amer. Forge Co., 2621 S. Hoyne Ave., Chicago.

SHAPES—Cold Drawn
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Pittsburgh

SHAPES—Cold Rolled
Britesun, Inc., Chicago.

SHAPES—Steel
Phoenix Iron Co., Phila.
Ryerson, Jos. T., & Son, Inc., Chicago.

SHAPES—Wire
Titchener, E. H., & Co., Binghamton, N. Y.

SHAPING MACHINES—Horizontal
American Tool Works Co., Cinci.
Cincinnati (O.) Shaper Co., The.
Crescent Machine Co., Leetonia, O.
Gould & Eberhardt, Newark, N. J.
Hendey Mch. Co., Torrington, Ct.
Ryerson, Jos. T., & Son, Inc., Chicago
Smith & Mills Co., Cinci.

SHEAR BLADES AND KNIVES
Atkins, E. C., & Co., Indianapolis, Ind.
Heppenstall Forge & Knife Co., Ptgh.
Marshalltown (Iowa) Mfg. Co.
Pittsburgh Forgings Co., Coraopolis, Pa.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Yoder Co., The, Cleveland.

SHEARING MACHINES—Alligator
Canton (O.) Fdry. & Mch. Co.
Roelker & Kirsten, 3105 Chambers St., Mil.
Hendley & Whittemore Co., Beloit, Wis.
Long & Allstatter Co., Hamilton, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Pels, Henry, & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Foot of 51st St., B'klyn, N. Y.
United Engrg. & Fdry. Co., Ptgh.

SHEARING MACHINES—Angle, Hand and Power
Cleveland (O.) Punch & Shear Wks. Co.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Pels, Henry, & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Foot of 51st St., B'klyn, N. Y.
Thomas Spacing Mach., Co., Ptgh., Pa.

SHEARING MACHINES — Automatic Alligator

Doelger & Kirsten, 3105 Chambers St., Mil.

SHEARING MACHINES—Bar

Aetna-Standard Eng. Co., Youngstown, O.
Beatty Mch. & Mfg. Co., Hammond, Ind.
Buffalo (N. Y.) Forge Co., 492 B'way.
Cleveland (O.) Punch & Shear Wks. Co.
Long & Allstatter Co., Hamilton, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Pels, Henry, & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Ft. of 51st St., Brooklyn, N. Y.

SHEARING MACHINES — Beam and Channel

Cleveland (O.) Punch & Shear Wks. Co.
Pels, Henry, & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Foot of 51st St., B'klyn, N. Y.

SHEARING MACHINES—Billet

Morgan Engineering Co., Alliance, O.
Pels, Henry & Co., 90 West St., N. Y. C.
Smith, David H., & Sons, Inc., Foot of 51st St., B'klyn, N. Y.
United Engrg. & Fdry. Co., Ptgh.

SHEARING MACHINES — Continuous Automatic

Yoder Co., The, Cleveland.

SHEARING MACHINES — Continuous Sheet & Pack

Streine Tool & Mfg. Co., New Bremen, O.

SHEARING MACHINES—Doubling and Squaring

United Engrg. & Fdry. Co., Ptgh.

SHEARING MACHINES — Metal Slitting

Buffalo (N. Y.) Forge Co., 492 B'way.
Hendley & Whittemore Co., Beloit, Wis.
Pels, Henry, & Co., 90 West St., N. Y. C.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Smith, David H., & Sons, Inc., Foot of 51st St., B'klyn, N. Y.

SHEARING MACHINES — Metal Slitting Gang

Adriance Mach. Works, Inc., 82 Richards St., Bklyn, N. Y.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Yoder Co., The, Cleveland.

SHEARING MACHINES—Plate

Bertsch & Co., Cambridge City, Ind.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Cleveland (O.) Punch & Shear Wks. Co.
Dreis & Krump Mfg. Co., Chicago.
Loy & Nawrath, Div. of Farrel-Birmingham Co., Inc., Derby, Conn.
Long & Allstatter Co., Hamilton, O.
Marshalltown (Iowa) Mfg. Co.
Mesta Mch. Co., Ptgh.
Morgan Engineering Co., Alliance, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Pels, Henry, & Co., 90 West St., N. Y. C.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Ryerson, Jos. T., & Son, Inc., Chicago.
Smith, David H., & Sons, Inc., Foot of 51st St., B'klyn, N. Y.
Thomas Spacing Mach., Co., Ptgh., Pa.
United Engrg. & Fdry. Co., Ptgh.
Wood, R. D., & Co., Philadelphia.
Yoder Co., The, Cleveland.

SHEARING MACHINES—Rotary for Irregular Cutting

Newbold, R. S., & Son Co., Norristown, Pa.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Ryerson, Jos. T., & Son, Inc., Chicago.
Yoder Co., The, Cleveland.

SHEARING MACHINES — Rotary Slitting Gang

Streine Tool & Mfg. Co., New Bremen, O.
Yoder Co., The, Cleveland.

SHEARING MACHINES — Sheet and Plate

Dreis & Krump Mfg. Co., Chicago.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner), St. Marys, O.
Streine Tool & Mfg. Co., New Bremen, O.
Yoder Co., The, Cleveland.

SHEARING MACHINES—Squaring

Dreis & Krump Mfg. Co., Chicago.
Streine Tool & Mfg. Co., New Bremen, O.
Toledo (O.) Mch. & Tool Co.

SHEET BARS

Andrews Steel Co., Newport, Ky.

SHEET METAL MACHINERY

Adriance Machine Wks., Inc., 82 Richards St., Bklyn, N. Y.
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co., The.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Dreis & Krump Mfg. Co., Chicago.
Excelsior Tool & Mch. Co., East St. Louis, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Kane & Roach, Syracuse, N. Y.
Loy & Nawrath, Div. of Farrel-Birmingham Co., Inc., Derby, Conn.
Newbold, R. S., & Son Co., Norristown, Pa.
New Albany (Ind.) Mch. Mfg. Co.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ohl, George A., & Co., Inc., Newark, N. J.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Streine Tool & Mfg. Co., New Bremen, O.
Standard Machinery Co., Auburn, R. I.
Toledo (O.) Machine & Tool Co.
V & O Press Co., Hudson, N. Y.
Yoder Co., The, Cleveland.

SHEET METAL WORK

Kelker Blower Co., Inc., Buffalo, N. Y.

SHEETS—Aluminum

Erdle Perforating Co., Rochester, N. Y.
Sheet Aluminum Corp., Jackson, Mich.

SHEETS—Auto Body

American Rolling Mill Co., Middletown, Ohio.
American Sheet & Tin Plate Co., Ptgh
Eastern Rolling Mill Co., Balto., Md.
Michigan Steel Corp., Detroit.
Newport (Ky.) Rolling Mill Co
Newton Steel Co., Youngstown, Ohio.
Youngstown (O.) Sheet & Tube Co.

SHEETS—Black

American Rolling Mill Co., Middletown, Ohio.
American Sheet & Tin Plate Co., Ptgh.
Beals, McCarthy & Rogers, Inc., Buffalo.
Bethlehem (Pa.) Steel Company.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Inc., Chicago.
Sharon (Pa.) Steel Hoop Co.
Weirton (W. Va.) Steel Co.

SHEETS—Blue Annealed

Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., Middletown, Ohio.
Bethlehem (Pa.) Steel Co.
Central Iron & Steel Co., Harrisburg, Pa.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Sharon (Pa.) Steel Hoop Co.

SHEETS—Box Annealed

Newport (Ky.) Rolling Mill Co.

SHEETS—Brass, Bronze, Copper, Nickel Silver or Phosphor Bronze

American Brass Co., Waterbury, Ct.
Phosphor Bronze Smelting Co., Phila.
Seymour (Ct.) Mfg. Co.

SHEETS—Copper Steel

Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.

SHEETS—Electrical

Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middletown, Ohio.
Newport (Ky.) Rolling Mill Co.

SHEETS — Enameling Stock (Genuine Open Hearth Iron)

American Rolling Mill Co., Middletown, Ohio.
Newport (Ky.) Rolling Mill Co.

SHEETS—For Drawing and Stamping

Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middletown, Ohio.
Eastern Rolling Mill Co., Balto., Md.
Firth-Sterling Steel Co., McKeesport, Pa.
Michigan Steel Corp., Detroit.
Newport (Ky.) Rolling Mill Co
Newton Steel Co., Youngstown, Ohio.
Sharon (Pa.) Steel Hoop Co.
Wheeling (W. Va.) Steel Corp.

SHEETS—Full Finished

American Rolling Mill Co., Middletown, Ohio.
Eastern Rolling Mill Co., Balto., Md.
Michigan Steel Corp., Detroit.
Newport (Ky.) Rolling Mill Co.
Newton Steel Co., Youngstown, Ohio.
Seneca Iron & Steel Co., Buffalo, N. Y.
Youngstown (O.) Sheet & Tube Co.

SHEETS—Galvanized, Flat and Corrugated

American Rolling Mill Co., Middletown, Ohio.
American Sheet & Tin Plate Co., Ptgh.
Bethlehem (Pa.) Steel Co.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Inc., Chicago.
Weirton (W. Va.) Steel Co.
Youngstown (O.) Sheet & Tube Co.

SHEETS—Locomotive Jacket

Newport (Ky.) Rolling Mill Co.

SHEETS—Metal Furniture

Allegheny Steel Co., Brackenridge, Pa.
Eastern Rolling Mill Co., Balto., Md.
Michigan Steel Corp., Detroit.
Newport (Ky.) Rolling Mill Co.
Seneca Iron & Steel Co., Buffalo, N. Y.

SHEETS—Pickled

Michigan Steel Corp., Detroit.
Newport (Ky.) Rolling Mill Co.

SHEETS—Polished

American Rolling Mill Co., Middletown, Ohio.

SHEETS—Zinc

St. Joseph Lead Co., 250 Park Ave., N. Y. C.

SHELLS—Brass and Copper

Bridgeport (Conn.) Brass Co.

SHELVING—Steel

Cleveland (O.) Wire Spring Co.
National Scale Corp., Chicopee Falls, Mass.

SHINGLES—Metal

Newport (Ky.) Rolling Mill Co.

SHIP BUILDERS' MATERIAL

Bethlehem (Pa.) Steel Co.

SHOP FURNITURE

New Britain-Gridley Mch. Co., The, New Britain, Ct.

SHUTTERS—Steel and wood Bi-Folding

Kinnear Mfg. Co., 817-67 Field Ave., Columbus, Ohio.

SILICON—Refined

Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y.

SLABS

Andrews Steel Co., Newport, Ky.

SLINGS—Wire Rope

Roebling's, John A., Sons Co., Trenton, N.J.

SLOTTING MACHINES

Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Nazel Engrg. & Mch. Wks., Phila.

SPACING TABLES—Punching & Shearing

Thomas Spacing Mach. Co., Ptgh., Pa.

SPECIAL MACHINERY

Bethlehem (Pa.) Steel Co.
Bullard Co., The, Bridgeport, Ct.
Central Mch. Wks., Worcester, Mass.
Cleveland (O.) Automatic Mch. Co., The.
Columbia Mch. Works & M. L. Co., 275 Chestnut St., Bklyn, N. Y.
Cook, Asa S., Co., Hartford, Ct.
Cowdrey, C. H., Machine Works, 30 Summer St., Fitchburg, Mass.
Eastern Tool & Mfg. Co., Bloomfield, N. J.
Hartford (Ct.) Special Mchry. Co.
Hill Clutch Mch. & Fdry. Co., Cleve., O.
Langelier Mfg. Co., Providence, R. I.
Lincoln Iron Wks., Rutland, Vt.
Littell, F. J., Mch. Co., Chicago.
Manville, E. J., Mach. Co., Waterbury, Ct.
Morgan Engineering Co., Alliance, O.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Sutton Engng. Co., Ptgh.
Treadwell Engineering Co., Easton, Pa.
Whiting Corp., Harvey, Ill.
Yoder Co., The, Cleveland.

SPEED REDUCERS

Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Cleveland (O.) Worm & Gear Co.
Jones, W. A., Foundry & Mach. Co., 4434 W. Roosevelt Road, Chicago.
Link-Belt Co., Chicago.
Palmer-Bee Co., Detroit.
Philadelphia (Pa.) Gear Works.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPIKES

American Steel & Wire Co., Chicago
Ames, W., & Co., Jersey City, N. J.
Bethlehem (Pa.) Steel Co.
Foster, L. B., Co., Ptgh.
Inland Steel Co., Chicago.
Wrought Iron Co. of America, Lebanon, Pa.

SPRING MAKING MACHINERY

Baird Machine Co., Bridgeport, Ct.
Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS—Car

American Steel & Wire Co., Chicago.
Miller & Van Winkle, Inc., 18 Bridge St., Bklyn, N. Y.

SPRINGS—Wire, Coil or Flat

Airplane Spring Co., 30 Main St., Brooklyn, N. Y.
Amer. Spring & Mfg. Corp., Holley, Mich.
American Steel & Wire Co., Chicago.
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Ct.
Bethlehem (Pa.) Steel Co.
Cleveland (O.) Wire Spring Co.
Cook Spring Div. of Barnes-Gibson-Raymond, Inc., Ann Arbor, Mich.
Cuyahoga Spring Co., Cleve.
Dunbar Bros. Co., Bristol, Ct.
Fischer, Chas., Spring Co., 242 Kent Ave., Bklyn, N. Y.
Gibson, Wm. D., Co., Chicago.
Hubbard M. D. Spring Co., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Kokomo (Ind.) Spring Co.
Lee Spring Co., Inc., 30 Main St., Bklyn., N. Y.
Miller & Van Winkle, Inc., 18 Bridge St., Bklyn, N. Y.
Peterson Spring Co., Detroit.
Raymond Mfg. Co., Corry, Pa.
Washburn Wire Co., Inc., 118th St. & Harlem River, N. Y. C.
Washburn Wire Co., Inc., Phillipsdale, R. I.
Wickwire Spencer Steel Co., 41 E. 42nd St., N. Y. C.

SPROCKETS

Boston Gear Works Sales Co., Norfolk Downs, Mass.
Dundore Mfg. Co., Reading, Pa.
Link-Belt Co., Chicago
Whitney Mfg. Co., Hartford, Ct.

STACKS—Steel

Chicago (Ill.) Bridge & Iron Wks.
Meehan Boiler & Construction Co., Lowellville, Ohio.

STAMPINGS OR DRAWINGS—Metal

Acme Stpg. & Mfg. Co., Pittsburgh.
Akron-Selle Co., Akron, Ohio.
Amer. Forging & Socket Co., Pontiac, Mich
American Pulley Co., Phila.
Amer. Spring & Mfg. Corp., Holley, Mich.
American Tube & Stpg. Plant (The Stanley Wks.), Bridgeport, Conn.
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Ct.
Behringer, E., Sheet Metal Wks., Inc., Newark, N. J.
Bossert Corp., The, Utica, N. Y.
Breese Bros. Co., Cincinnati.
Bridgeport (Conn.) Brass Co.
Burgess-Norton Mfg. Co., Geneva, Ill.
Columbian Enameling & Stamping Co., Terre Haute, Ind.
Cook, H. C., Co., Ansonia, Ct.
Cook Spring Div. of Barnes-Gibson-Raymond, Inc., Ann Arbor, Mich.
Crosby Company, The, Buffalo, N. Y.
Cuyahoga Spring Co., Cleve.
Davis Brake Beam Co., Johnstown, Pa.
Detroit (Mich.) Metal Specialty Corp.
Detroit (Mich.) Stamping Co.
Douglas & Lomason Co., Detroit.
Eastern Tool & Stpg. Co., Inc., Saugus, Mass.
Erdle Perforating Co., Rochester, N. Y.
Fischer, Chas., Spring Co., 242 Kent Ave., Brooklyn, N. Y.
General Mach. & Mfg. Co., Bridgeport, Ct.
Globe Mach. & Stpg. Co., Cleve.
Great Lakes Pressed Steel Corp., Buffalo, N. Y.
Hager, C., & Sons Hinge Mfg. Co., St. Louis, Mo.
Hubbard, M. D., Spring Co., Pontiac, Mich.
Huebel Mfg. Co., Inc., Newark, N. J.
Hunter Pressed Steel Co., Lansdale, Pa.
Konigslow, E., Stpg. & Tool Co., The, Cleveland, Ohio.
Konigslow, Otto, Mfg. Co., Cleve.
Lansing (Mich.) Stpg. Co.
Matthews Mfg. Co., Worcester, Mass.
Metal Specialty Co., Cincinnati.
Miller & Van Winkle, Inc., 18 Bridge St., Bklyn., N. Y.
New England Pressed Steel Co., 1 Washington Ave., Natick, Mass.
Parish Pressed Steel Co., Reading, Pa.
Penn Jersey Metal Products Corp., Camden, N. J.
Robinson Tool Works, Inc., Waterbury, Ct.
Saginaw (Mich.) Stpg. & Tool Co.
St. Paul (Minn) Corrugating Co.
Schollhorn, Wm. Co., The, New Haven, Conn.
Sessions, J. H., & Son, Bristol, Ct.
Seymour (Ct.) Products Co., The.
Smith, Thomas, Co., 286 Grove St., Worcester, Mass.
Stanley Works, The, New Britain, Ct.
Torrington (Ct.) Co.
Veeder-Root, Inc., Hartford, Ct.
Wilkoff, Wm., Inc., Niles, O.
Worcester (Mass.) Stamped Metal Co.
York (Pa.) Corrugating Co.

STAMPS—Steel Alphabets and Figures

Noble & Westbrook Mfg. Co., Hartford, Ct.
Schwerdtle Stamp Co., Bridgeport, Ct.

STAPLES—Wire

American Steel & Wire Co., Chicago.
Titchener, E. H., & Co., Binghamton, N. Y.

STEEL—Alloy

Alan Wood Steel Co., Conshohocken, Pa.
Allen, Edgar, Steel Co., Inc., 745 Washington St., N. Y. C.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Co.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Hawkridge Bros. Co., Boston.
Heller Bros. Co., Newark, N. J.
Heppenstall Forge & Knife Co., Ptgh.
Interstate Iron & Steel Co., Chicago.
Jessop Steel Co., Washington, Pa.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.
Latrobe (Pa.) Electric Steel Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Simonds Saw & Steel Co., Lockport, N. Y.
Timken Steel & Tube Co., The, Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Alloy, Cold Drawn

Moltrup Steel Products Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.

STEEL—Bright Finished

Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Ptgh.

STEEL—Carbon

Andrews Steel Co., The, Newport, Ky.
Carnegie Steel Co., Pittsburgh.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.
Latrobe (Pa.) Electric Steel Co.

STEEL—Carbon Vanadium

Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.
Vulcan Crucible Steel Co., Aliquippa, Pa.

STEEL—Chrome

Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Manganese

Latrobe (Pa.) Electric Steel Co.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Chrome Nickel

Andrews Steel Co., Newport, Ky.

STEEL—Chrome Vanadium

Andrews Steel Co., Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL—Cobalt

Darwin & Milner, Inc., Cleveland.

STEEL—Cold Drawn

American Steel & Wire Co., Chicago.
Bethlehem (Pa.) Steel Co.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Globe Wire Company, Sharpsburg, Pa.
Latrobe (Pa.) Electric Steel Co.
Moltrup Steel Prods. Co., Beaver Falls, Pa.
Rathbone, A. B. & J., Palmer, Mass.
Union Drawn Steel Co., Beaver Falls, Pa.
Wetherell Bros. Co., Cambridge, 39, Mass.
Wyckoff Drawn Steel Co., Ptgh.

STEEL—Cold Rolled Strips

Acme Steel Co., Chicago.
American Steel & Wire Co., Chicago.
American Tube & Stpg. Plant (The Stanley Wks.), Bridgeport, Conn.
Athenia Steel Co., 125 William St., N. Y.
Beals, McCarthy & Rogers, Inc., Buffalo.
Cold Metal Process Co., Youngstown, Ohio.
Griffin Mfg. Co., Erie, Pa.
Latrobe (Pa.) Electric Steel Co.
Morris & Bailey Division Oliver Iron & Steel Corp., Ptgh.
Stanley Works, The, New Britain, Ct.

Superior Steel Corp., Union Trust Bldg., Ptgh.
Washburn Wire Co., Inc., Phillipsdale, R. I.
Washburn Wire Co., Inc., 118th St. & Harlem River, N. Y. C.
Weirton (W. Va.) Steel Co.
West Leechburg Steel Co., Ptgh.
Wetherell Bros. Co., Cambridge, 39, Mass.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

STEEL—Crucible

Columbia Tool Steel Co., Chicago Hgts., Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop Steel Co., Washington, Pa.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.

STEEL—Cutlery

Firth-Sterling Steel Co., McKeesport, Pa.
Jessop Steel Co., Washington, Pa.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.
Latrobe (Pa.) Electric Steel Co.
Wetherell Bros. Co., Cambridge, 39, Mass.

STEEL—Die

Allen, Edgar, Steel Co., Inc., 745 Washington St., N. Y. C.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Disston, Henry, & Sons, Inc., Phila.
Firth-Sterling Steel Co., McKeesport, Pa.
Heppenstall Forge & Knife Co., Ptgh.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.
Latrobe (Pa.) Electric Steel Co.
Swedish-American Steel Corp., 427 Kent Ave., Brooklyn, N. Y.

STEEL—Drill

Heller Bros. Co., Newark, N. J.
Latrobe (Pa.) Electric Steel Co.

STEEL—Electric

Disston, Henry, & Sons, Inc., Phila.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Hawkridge Bros. Co., Boston.
Latrobe (Pa.) Electric Steel Co.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Fabricated (Alloy)

Pittsburgh (Pa.) Producers Supply Co.

STEEL—High Speed

Allen, Edgar, Steel Co., Inc., 745 Washington St., N. Y. C.
Columbia Tool Steel Co., Chicago Hgts., Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Hawkridge Bros. Co., Boston.
Heller Bros. Co., Newark, N. J.
Jessop Steel Co., Washington, Pa.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.
Latrobe (Pa.) Elec. Steel Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Simonds Saw & Steel Co., Lockport, N. Y.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Hot Rolled Strips

Acme Steel Co., Chicago.
American Tube & Stpg. Plant (The Stanley Wks.), Bridgeport, Conn.
Barnes, Wallace, Co., The, Bristol, Ct.
Griffin Mfg. Co., Erie, Pa.
Laclede Steel Co., St. Louis, Mo.
Latrobe (Pa.) Elec. Steel Co.
Sharon (Pa.) Steel Hoop Co.
Stanley Works, The, New Britain, Ct.
Superior Steel Corp., Union Trust Bldg., Ptgh.
West Leechburg Steel Co., Ptgh.

STEEL—Importers

Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.

STEEL—Magnet

Latrobe (Pa.) Elec. Steel Co.
Simonds Saw & Steel Co., Lockport, N. Y.

STEEL—Manganese

Frog, Switch & Mfg. Co., The, Carlisle, Pa.

STEEL—Manganese Rolled or Forged

Manganese Steel Forge Co., Phila.

STEEL—Nickel

Andrews Steel Co., Newport, Ky.

STEEL—Open Hearth

Andrews Steel Co., The, Newport, Ky.
Driver-Harris Co., Harrison, N. J.
Jones & Laughlin Steel Corp., Ptgh.
Sharon (Pa.) Steel Hoop Co.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Rustless

Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe (Pa.) Electric Steel Co.
Rustless Iron Corp. of America, 122 E. 42nd St., N. Y. C.

STEEL—Screw

American Steel & Wire Co., Chicago.
Jones & Laughlin Steel Corp., Ptgh.
Timken Steel & Tube Co., The, Canton, O.
Union Drawn Steel Co., Beaver Falls, Pa.
Wyckoff Drawn Steel Co., Ptgh.

STEEL—Special Analysis

Andrews Steel Co., The, Newport, Ky.
Hawkridge Bros. Co., Boston.
Latrobe (Pa.) Electric Steel Co.
Timken Steel & Tube Co., The, Canton, O.
West Leechburg Steel Co., Ptgh.

STEEL—Spring

Athenia Steel Co., 135 William St., N. Y.
Barnes, Wallace, Co., The, Bristol, Ct.
Bethlehem (Pa.) Steel Co.
Hawkridge Bros. Co., Boston.
Ryerson, Jos. T., & Son, Inc., Chicago.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Stainless

Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.
Firth-Sterling Steel Co., McKeesport, Pa.
Hawkridge Bros. Co., Boston.
Latrobe (Pa.) Electric Steel Co.

STEEL—Tool

Allen, Edgar, Steel Co., Inc., 745 Washington St., N. Y. C.
Beals, McCarthy & Rogers, Inc., Buffalo.
Bethlehem (Pa.) Steel Co.
Columbia Tool Steel Co., Chicago Hgts., Ill.
Darwin & Milner, Inc., Cleveland.
Disston, Henry, & Sons, Inc., Phila.
Firth-Sterling Steel Co., McKeesport, Pa.
Hawkridge Bros. Co., Boston.
Heller Bros. Co., Newark, N. J.
Jessop Steel Co., Washington, Pa.
Jessop, Wm., & Sons, Inc., 121 Varick St., N. Y. C.
Latrobe (Pa.) Electric Steel Co.
Midvale Co., The, Nicetown, Phila., Pa.
Milne, A., & Co., 745 Washington St., N. Y. C.
Ryerson, Jos. T., & Son, Inc., Chicago.
Simonds Saw & Steel Co., Lockport, N. Y.
Swedish-American Steel Corp., 427 Kent Ave., Brooklyn, N. Y.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wetherell Bros. Co., Cambridge 39, Mass.

STEEL—Tool, Special Shapes

Heller Bros. Co., Newark, N. J.
Latrobe (Pa.) Electric Steel Co.

STEEL—Vanadium

Andrews Steel Co., Newport, Ky.
Latrobe (Pa.) Elec. Steel Co.

STEEL PLANTS AND ROLLING MILLS

McKee, Arthur G., & Co., Cleve.
Perin & Marshall, 11 West 42nd St., N. Y. C.

STEEL PLATE CONSTRUCTION

Chicago (Ill.) Bridge & Iron Wks.
Cole, R. D., Mfg. Co., Newnan, Ga.
Jones & Laughlin Steel Corp., Ptgh.
Lancaster (Pa.) Iron Works, Inc.
Meehan Boiler & Construction Co., Lowellville, Ohio.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B., Co., Youngstown, O.
Riter-Conley Co., Ptgh.
Steel Plates Products Co., Pottstown, Pa.

STEEL ROLLS

Heppenstall Forge & Knife Co., Ptgh.

STEPS—Ladder & Stair, Safety

Blaw-Knox Co., Ptgh.

STEPS—Safety

Hendrick Mfg. Co., Carbondale, Pa.
Irving Iron Works Co., L. I. City, N. Y.

STOCKS AND DIES

Jones & Lamson Mach. Co., Springfield, Vt.
Saunders', D., Sons, Yonkers, N. Y.

STOKERS

Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

STOOLS—Steel

Angle Steel Stool Co., Plainwell, Mich.
Vitek Mfg. Co., Omaha, Neb.

STOOLS—Steel, Adjustable

Vitek Mfg. Co., Omaha, Neb.

STOPPERS—Open-Hearth, Bessemer or Electric Furnace

McCullough-Dalzell Crucible Co., Ptgh.
Ross-Tacony Crucible Co., Phila.

STOVES—Hot Blast

Brassert, H. A., & Co., Chicago.

STRAIGHTENING MACHINES

Aetna-Standard Eng. Co., Youngstown, O.
Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Kane & Roach, Syracuse, N. Y.
Newbold, R. S., & Son Co., Norristown, Pa.
Pels, Henry, & Co., 90 West St., N. Y. C.
Sutton Engng. Co., Ptgh.
Thomas Spacing Mch. Co., Ptgh., Pa.
Whitney Metal Tool Co., Rockford, Ill.

STRAIGHTENING MACHINES—Wire

Lewis Mch. Co., The, Cleveland, Ohio.
Shuster, F. B., Co., New Haven, Ct.

STRAIGHTENING AND SHEARING MACHINES—Rod, Gaggers

American Fdry. Equip. Co., Mishawaka, Ind.

STRUCTURAL IRON AND STEEL WORK

American Bridge Co., 71 B'way, N. Y. C.
Austin Co., The, Cleveland.
Belmont Iron Wks., Phila.
Bethlehem (Pa.) Steel Co.
Morgan Engng. Co., Alliance, O.
Palmer-Bee Co., Detroit.
Phoenix Iron Co., Phila.
Shoemaker Bridge Co., Pottstown, Pa.
Virginia Bridge & Iron Co., Roanoke, Va.
Wellman-Seaver-Morgan Co., Cleveland.

STRUCTURAL STEEL — See Angles, Beams, Channels and Tees

STUDS

Lake Erie Bolt & Nut Co., The, Cleveland.

SULPHATE OF IRON

American Steel & Wire Co., Chicago.

SUPERHEATERS

Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

SWAGING MACHINES

Langelier Mfg. Co., Providence, R. I.
Etna Machine Co., The, Toledo.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.
Standard Machinery Co., Auburn, R. I.
Torrington (Ct.) Co.

SWITCHES—Electric

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

TACHOMETERS

Brown Instrument Co., The, Philadelphia.

TACHOMETERS—Angular and Linear Velocity

Barbour-Stockwell Co., Cambridge, Mass.

TACKS

American Steel & Wire Co., Chicago.

TANKS—Compressed Air, Gas, Oil and Water

Air-Tight Steel Tank Co., Ptgh.
Caldwell, W. E., Co., 1940 Brook St., Louisville, Ky.
Kellogg, M. W., Co., The, 225 Bdway, N. Y. C.
Petroleum Iron Works Co., Sharon, Pa.
Scaife, Wm. B., & Sons Co., Ptgh.
Westinghouse Traction Brake Co., Wilmerding, Pa.

TANKS—Elevated Steel

Chicago (Ill.) Bridge & Iron Wks.
Cole, R. D., Mfg. Co., Newnan, Ga.

TANKS—Elevated Wood

Caldwell, W. E., Co., 1940 Brook St., Louisville, Ky.
Hauser-Stander Tank Co., Cinci.

TANKS—Gasoline & Oil

Chicago (Ill.) Bridge & Iron Wks.

TANKS—Iron and Steel

Alliance (O.) Tank Co.
Caldwell, W. E., Co., 1940 Brook St., Louisville, Ky.
Chicago (Ill.) Bridge & Iron Wks.
Janney, Joseph A., Jr., Phila.
Kellogg, M. W., Co., The, 225 Bdway, N. Y. C.
Lancaster (Pa.) Iron Works, Inc.
Scaife, Wm. B., & Sons Co., Ptgh.
Steel Plate Products Co., Pottstown, Pa.

TANKS—Lead Lined

Gross Lead Burning & Coating Corp., Cleveland.

TANKS—Pickling

Hauser-Stander Tank Co., Cinci.
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.
Woolford, G., Wood Tank Mfg. Co., Phila.

TANKS—Rubber Lined

Hauser-Stander Tank Co., Cincinnati.

TANKS—Water

Hauser-Stander Tank Co., Cinci.

TANKS—Welded

Air-Tight Steel Tank Co., Ptgh.
Alliance (O.) Tank Co.
Scaife, Wm. B., & Sons Co., Ptgh.

TANKS—Wood

Caldwell, W. E., Co., 1940 Brook St., Louisville, Ky.
Hauser-Stander Tank Co., Cincinnati.
Woolford, G., Wood Tank Mfg. Co., Phila.

TAPER PINS

Buffalo (N. Y.) Mch. Key Co.
Leard, William Co., New Brighton, Pa.

TAPPING MACHINES

Baker Bros., Inc., Toledo.
Barnes Drill Co., Inc., Rockford, Ill.
Defiance (O.) Machine Works.
Langelier Mfg. Co., Providence, R. I.
National Automatic Tool Co., Richmond, Ind.
Whitney Metal Tool Co., Rockford, Ill.

TAPPING MACHINES—Nuts

National Mchry. Co., Tiffin, Ohio.

TAPS—Collapsing

Geometric Tool Co., New Haven, Conn.
Landis Mach. Co., Inc., Waynesboro, Pa.
Murchey Mach. & Tool Co., 951 Porter St., Detroit.
National Acme Co., The, Cleve.
Pipe Mchry. Co., Cleveland.

TAPS AND DIES

Brubaker, W. L., & Bros., Co., 50 Church St., N. Y. C.
Landis Mch. Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
National Acme Co., The, Cleve.
Pipe Mchry. Co., Cleveland.

TEES—See Angles, Beams, Channels and Tees

TELEPHONES—Interior

Screw Machine Products Corp., Prov., R. I.

TERNE PLATES

American Sheet & Tin Plate Co., Ptgh.

TESTING MACHINES—Materials

Olsen, Tinius Testing Mch. Co., Phila.
Southwark Fdry. & Mch. Co., Phila.

THERMOMETERS—Indicating

Brown Instrument Co., The, Philadelphia.

THERMOMETERS—Recording

Brown Instrument Co., The, Philadelphia.
Taylor Instrument Companies, Rochester, N. Y.

THREAD CUTTING TOOLS—See Dies, Taps, Screw Plates, etc.

THREAD MILLING MACHINERY

Lees-Bradner Co., Cleveland.

THREAD ROLLING MACHINES

Nilson, A. H., Mach. Co., Bridgeport, Ct.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.

THREADING MACHINES

Geometric Tool Co., New Haven, Conn.
National Mchry. Co., Tiffin, Ohio.

TIE PLATES

Inland Steel Co., Chicago.
Joliet (Ill.) Wrought Washer Co.

TIES—Bale

American Steel & Wire Co., Chicago.

TIES—Creosoted

Century Wood Preserving Co., Ptgh.
Jennison-Wright Co., Toledo

TILE—Cement Roofing

American Cement Tile Mfg. Co., 803 Oliver Bldg., Ptgh.

TIMBERS—Creosoted

Jennison-Wright Co., Toledo

TIN PLATE

American Sheet & Tin Plate Co., Ptgh.
Weirton (W. Va.) Steel Co.
Youngstown (O.) Sheet & Tube Co.

TIN PLATE MACHINERY

Aetna-Standard Eng. Co., Youngstown, O.
Wean Engng. Co., Inc., The, Warren, O.

TINNERS' TOOLS AND MACHINES

Niagara Mch. & Tool Wks., Buffalo, N. Y.
Quickwork Co., The (Not Incorporated—H. Collier Smith, Owner) St. Marys, O.

TINNING EQUIPMENT—Sheets

Wean Engng. Co., Inc., The, Warren, O.

TOOL BITS

Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Prosser, Thomas & Son, Widia Dept., 15 Gold St., N. Y. C.

TOOL HOLDERS

Armstrong Bros. Tool Co., Chicago.
Century Mch. & Tool Co., 423 Kent Ave., Brooklyn, N. Y.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Williams, J. H., & Co., Buffalo, N. Y.

TOOLS, JIGS, FIXTURES, ETC.

Hamilton (O.) Tool Co., The.
Swanson Mch. Co., Jamestown, N. Y.

TOOLS—Lathe

Armstrong Bros. Tool Co., Chicago.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Prosser, Thomas & Son, Widia Dept., 15 Gold St., N. Y. C.

TOOLS—Metal Cutting

Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Prosser, Thomas & Son, Widia Dept., 15 Gold St., N. Y. C.

TOOLS—Slag Digging

Rivet Cutting Gun Co., Cinn.

TOOLS—Steam and Gas Fitters

Saunders', D., Sons, Yonkers, N. Y.

TORCHES—Blow

Anthony Co., L. I. C., N. Y.
Hauck Mfg. Co., 128 10th St., Bklyn, N. Y.

TORCHES—Brazing, Cutting & Welding

Harris Calorific Co., Cleveland.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.

TORCHES—Heating

Williams, G. H., Co., Erie, Pa.

TOWERS—Steel

Blaw-Knox Co., Ptgh.
Caldwell, W. E., Co., 1940 Brook St., Louisville, Ky.

TOWERS—Transmission

Blaw-Knox Co., Ptgh.

TOWERS—Water—See Tanks—Elevated Steel and Elevated Wood

TRACK—Industrial

Bethlehem (Pa.) Steel Co.

TRACK—Monorail

American MonoRail Co., The, Cleveland.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

TRACTORS AND TRAILERS—See Trucks, Tractors and Trailers—Industrial

TRAILERS—Industrial—See Trucks, Tractors and Trailers—Industrial

TRAMRAILS—Overhead Systems

Armington Engineering Co., Euclid, O.
Cleveland Electric Tramrail, Wickliffe, O.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

TRAMWAYS—Wire Rope

American Steel & Wire Co., Chicago.
Broderick & Bascom Rope Co., St. Louis
Leschen, A., & Sons Rope Co., St. Louis

TRANSFER TABLES

Whiting Corp., Harvey, Ill.

TRANSFORMATION POINT RECORDERS

Brown Instrument Co., The, Philadelphia.

TRAPS—Steam and Radiator

Johns-Manville Corp., 292 Madison Ave., N. Y. C.
Strong, Carlisle & Hammond Co., Cleve.

TROLLEYS

Conkey, H. D., & Co., 36 So. Jefferson St., Mendota, Ill.
Ford Chain Block Co., Phila.
Hayna Engineering Works, Chicago.
Palmer-Bee Co., Detroit.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Wright Mfg. Co., Bridgeport, Ct.
Yale & Towne Mfg. Co., Stamford, Ct.

TROLLEYS—Monorail

American MonoRail Co., The, Cleveland.

TRUCKS—Dump (Power)

Crescent Truck Co., Lebanon, Pa.

TRUCKS—Elevating (Power)

Automatic Transportation Co., Inc., Buffalo, N. Y.
Baker-Raulang Co., Cleveland.
Crescent Truck Co., Lebanon, Pa.
Ready-Power Co., Detroit, Mich.

Wright-Hibbard Industrial Elec. Truck Co., Inc., Phelps, N. Y.
Yale & Towne Mfg. Co., Stamford, Ct.

TRUCKS—Lift (Hand)

Lewis-Shepard Co., 122 Walnut St., Watertown Station, Boston
National Scale Corp., Chicopee Falls, Mass.
Yale & Towne Mfg. Co., Stamford, Ct.

TRUCKS—Steel Shop

American Pulley Co., Philadelphia

TRUCKS—Two Wheel Hand

American Pulley Co., Philadelphia

TRUCKS, TRACTORS AND TRAILERS—Industrial

Atlas Car & Mfg. Co., Cleve.
Automatic Transportation Co., Inc., Buffalo, N. Y.
Baker-Raulang Co., Cleveland.
Chase Fdry. & Mfg. Co., Columbus, O.
Crescent Truck Co., Lebanon, Pa.
Sterling Wheelbarrow Co., Milwaukee.
Ready Power Co., Detroit, Mich.
Wright-Hibbard Industrial Elec. Truck Co., Inc., Phelps, N. Y.
Yale & Towne Mfg. Co., Stamford, Ct.

TUBE FORMING MACHINES

Yoder Co., The, Cleveland.

TUBE MILL MACHINERY

Aetna-Standard Eng. Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdry. Co., Pgh.
Wellman-Seaver-Morgan Co., Cleveland.

TUBES—Boiler

Allegheny Steel Co., Brackenridge, Pa.
Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.
Cornell & Underhill Spring & Greenwich Sts., N. Y. C.
Giberson, E. D., & Co., Inc., 40 Rector St., N. Y. C.
Keating, E. F., Co., 452 Water st., N. Y. C.
Ryerson, Jos. T., & Son, Inc., Chicago.
Seneca Wire & Mfg. Co., Fostoria, O.
Tyler Tube & Pipe Co., The, Washington, Pa.

TUBES—Boiler, Charcoal Iron

Bethlehem (Pa.) Steel Co.
Keating, E. F., Co., 452 Water St., N. Y.
Seneca Wire & Mfg. Co., Fostoria, O.
Tyler Tube & Pipe Co., Washington, Pa.

TUBES—Nickel Silver

American Brass Co., Waterbury, Ct.
Summerill Tubing Co., Bridgeport, Montgomery County, Pa.

TUBING—Aluminum, Seamless

Summerill Tubing Co., Bridgeport, Montgomery County, Pa.

TUBING—Brass, Bronze, Copper or Nickel Silver

American Brass Co., Waterbury, Ct.
Service Steel Co., Detroit
Summerill Tubing Co., Bridgeport, Montgomery County, Pa.
Wolverine Tube Co., Detroit.

TUBING—Chrome Alloy

Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.

TUBING—Condenser

American Brass Co., Waterbury, Ct.

TUBING—Open Seam

Michigan Steel Tube Prods. Co., Detroit.

TUBING—Phosphor Bronze

Phosphor Bronze Smelting Co., Phila.

TUBING—Seamless Iron

Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.

TUBING—Seamless Steel

Babcock & Wilcox Tube Co., The, 85 Liberty St., N. Y. C.
Cleveland (O.) Tool & Supply Co.
Giberson, E. D., & Co., Inc., 40 Rector St., N. Y. C.
Jones & Laughlin Steel Corp., Pgh.
Keating, E. F., Co., 452 Water St., N. Y. C.
Service Steel Co., Detroit.
Summerill Tubing Co., Bridgeport, Montgomery County, Pa.
Timken Steel & Tube Co., The, Canton, O.
Youngstown (O.) Sheet & Tube Co.

TUBING—Square and Rectangular

Service Steel Co., Detroit.
Summerill Tubing Co., Bridgeport, Montgomery County, Pa.

TUBING—Welded Steel

Michigan Steel Tube Prods. Co., Detroit.
Service Steel Co., Detroit.
Tyler Tube & Pipe Co., The, Washington, Pa.
Youngstown (O.) Sheet & Tube Co.

TUBING MACHINERY—Brazed

Etna Machine Co., The, Toledo

TUBULAR PRODUCTS

Cleveland (O.) Tool & Supply Co.
Michigan Steel Tube Products Co., Detroit.
Service Steel Co., Detroit.

TUMBLING BARRELS

Baird Machine Co., Bridgeport, Ct.
Globe Mach. & Stmp. Co., Cleve.
Ransohoff, N., Inc., Cinn., Ohio.
Royersford (Pa.) Fdry. & Mch. Co., Inc.
Sly, W., Mfg. Co., Cleveland, O.
Whiting Corp., Harvey, Ill.

TURBINES

De Laval Steam Turbine Co., Trenton, N. J.

TURNBUCKLES

Lloyd Forge Co., Annville, Pa.
Merrill Bros., Maspeth, N. Y.

TURNTABLES

Canton (O.) Fdry. & Mch. Co.

TWIST DRILLS

Cleveland (O.) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

TYPE—Steel

Noble & Westbrook Mfg. Co., Hartford, Ct.

UNIONS

Dart, E. M., Mfg. Co., Prov., R. I.

VALVE DISCS

Garlock Packing Co., Palmyra, N. Y.

VALVES—Air Operating

Westinghouse Traction Brake Co., Wilmerding, Pa.

VALVES—Gas and Air Reversing

Blaw-Knox Co., Pgh.
Swindell, W., & Bros., Box 1753, Pgh.
Wellman-Seaver-Morgan Co., Cleveland.

VALVES—Gas, Water and Steam

Cornell & Underhill, Spring & Greenwich Sts., N. Y. C.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Wood, R. D., & Co., Philadelphia.

VALVES—Hydraulic

Anker Engng. Co., Phila.
Birdsboro (Pa.) Steel Fdry. & Mch. Co.
Galland-Henning Mfg. Co., Milwaukee.
Watson-Stillman Co., The, 71 West St., N. Y. C.
Wood, R. D., & Co., Philadelphia.

VALVES—(Pressure Seated) Pneumatic

Cleveland (O.) Pneumatic Tool Co., The

VALVES—Pump, Rubber

Garlock Packing Co., Palmyra, N. Y.

VISES

Eagle Anvil Works, Trenton, N. J.
Jarecki Mfg. Co., Erie, Pa.

VISES—Machine, Compensating

Avey Drilling Mch. Co., Cincinnati, O.

WALKWAYS—Open Steel

Irving Iron Works Co., L. I. City, N. Y.

WASHERS—Gas

Brassert, H. A., & Co., Chicago.

WASHERS—Iron or Steel

Bethlehem (Pa.) Steel Co.
Griffin Mfg. Co., Erie, Pa.
Hager, C., & Sons Hinge Mfg. Co., St. Louis, Mo.
Joliet (Ill.) Wrought Washer Co.
Kantlink Mfrs., 40 Hermon St., Newark, N. J.
Lake Erie Bolt & Nut Co., The, Cleveland, Ohio.
Nineteen Plate Washer Co., Inc., Phila.
Sessions, J. H., & Son, Bristol, Ct.
Smith, Thomas, Co., 286 Grove St., Worcester, Mass.
Wrought Washer Mfg. Co., Milwaukee.

WASHERS—Leather

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WASHERS—Lock

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WASHERS—Special

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WASHERS—Spring Lock

Kantlink Mfrs., 40 Hermon St., Newark, N. J.

WASHERS—Spring Steel

Dunbar Bros. Co., Bristol, Ct.
Kantlink Mfrs., 40 Hermon St., Newark, N. J.

WASHERS—Tempered

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Federal Mch. & Welder Co., Warren, O.
General Welder Co., The, Akron, Ohio.
Pittsburgh (Pa.) Producers Supply Co.
Thomson-Gibb Electric Welding Co., 661 Pleasant St., Lynn, Mass.

WELDING—Forge & Hammer

Blaw-Knox Co., Pittsburgh

WELDING—Oxy-Acetylene

Blaw-Knox Co., Pittsburgh
Harris Calorific Co., Cleveland.
Pittsburgh (Pa.) Producers Supply Co.
Weldit Acetylene Co., Detroit.

WELDING—Thermit

Metal & Thermit Corp., 120 Broadway, N. Y. C.

WELDING AND CUTTING MACHINES AND EQUIPMENT—Oxy-Acetylene

Air Reduction Sales Co., 342 Madison Ave., N. Y. C.
Harris Calorific Co., Cleveland.
International Oxygen Co., Newark, N. J.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.
Weldit Acetylene Co., Detroit.

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Swift Electric Welder Co., Blvd Temple Bldg., West Grand Blvd. at 12th St., Detroit.
Taylor-Winfield Corp., The, Warren, O.
Thomson-Gibb Electric Welding Co., 661 Pleasant St., Lynn, Mass.

WELDING MACHINES—(Electric Arc), Second-Hand

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Goodman Elec. Mchry. Co., Newark, N. J.
Service Co., Cleveland, Ohio.

WELDING MACHINES—(Gas Driven), Second-Hand

Burdett Oxygen Co., The, Cleveland, O.

WELDING MACHINES—Seam

Federal Mch. & Welder Co., Warren, O.
General Welder Co., The, Akron, Ohio.
Taylor-Winfield Corp., The, Warren, O.

WELDING MACHINES—Spot

Agnew Elec. Welder Co., Inc., Milford, Mich.
Federal Mch. & Welder Co., Warren, O.
General Welder Co., The, Akron, Ohio.
Swift Electric Welder Co., Blvd Temple Bldg., West Grand Blvd. at 12th St., Detroit.
Thomson-Gibb Electric Welding Co., 661 Pleasant St., Lynn, Mass.

WELDING MACHINES—(Spot), Second Hand

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WHEELBARROWS—Foundry

Sterling Wheelbarrow Co., Milwaukee.

WHEELS—Conveyor

Saginaw (Mich.) Stpg. & Tool Co.

WHEELS—Rolled Steel

Bethlehem (Pa.) Steel Co.
Carnegie Steel Co., Pgh.

WINCHES

Chicago Pneumatic Tool Co., 6 East 44th St., N. Y. C.

WINDOWS—Steel

Truscon Steel Co., Youngstown.

WIRE—Alloy Steel

Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE—Aluminum

Sheet Aluminum Corp., Jackson, Mich.

WIRE—Barb

American Steel & Wire Co., Chicago.
Bethlehem (Pa.) Steel Co.
Jones & Laughlin Steel Corp., Pgh.

WIRE—Brass, Bronze, Copper, Nickel Silver or Phosphor Bronze

American Brass Co., Waterbury, Ct.
Phosphor Bronze Smelting Co., Phila.
Seymour (Ct.) Mfg. Co.

WIRE—Broom

American Steel & Wire Co., Chicago.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE—Electric Heat Resisting

Globar Corp., Niagara Falls, N. Y.

WIRE—Flat, Round, Square or Special Shapes

American Steel & Wire Co., Chicago.
Harlshorn, Stewart, Co., 250 Fifth Ave., N. Y. C.
Page Steel & Wire Co., Bridgeport, Ct.
Prentiss, Geo. W., & Co., Holyoke, Mass.
Roebling's, John A., Sons Co., Trenton, N. J.
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Washburn Wire Co., Inc., 118th St. & Harlem River, N. Y. C.
Washburn Wire Co., Inc., Phillipsdale, R. I.
Webb Wire Works, New Brunswick, N. J.
Wickwire Bros., Cortland, N. Y.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

WIRE—Insulated

American Steel & Wire Co., Chicago.

WIRE—Mattress

American Steel & Wire Co., Chicago.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE—Netting

American Steel & Wire Co., Chicago.
Bethlehem (Pa.) Steel Co.
Wickwire Brothers, Cortland, N. Y.

WIRE—Piano and Music

American Steel & Wire Co., Chicago.
Washburn Wire Co., Phillipsdale, R. I.
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WIRE—Rubber Covered

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Hazard Wire Rope Co., Wilkes-Barre, Pa.

WIRE—Special Drawn Shapes

Rathbone, A. B., & J. Palmer, Mass.

WIRE—Spoke and Crimping

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WIRE—Steel

Johnson Steel & Wire Co., Inc., Worcester, Mass.
Wheeling (W. Va.) Steel Corp.

WIRE—Telephone and Telegraph

American Steel & Wire Co., Chicago.

WIRE—Trolley

American Steel & Wire Co., Chicago.

WIRE—Welding

American Steel & Wire Co., Chicago.
Oxweld Acetylene Co., 30 E. 42nd St., N. Y. C.
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Ryerson, Jos. T., & Son, Inc., Chicago
Seneca Wire & Mfg. Co., The, Fostoria, Ohio
Wickwire Spencer Steel Co., 41 E. 42nd St., N. Y. C.

WIRE—Wire Cloth

Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE CLOTH

Buffalo (N. Y.) Wire Wks. Co., Inc.
Wickwire Bros., Cortland, N. Y.
Wickwire Spencer Steel Co., 41 E. 42nd, N. Y. C.

WIRE COILING AND SPIRALLING MACHINERY

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WIRE DRAWING MACHINERY

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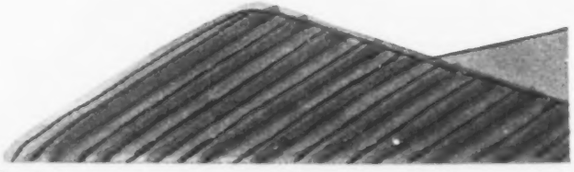
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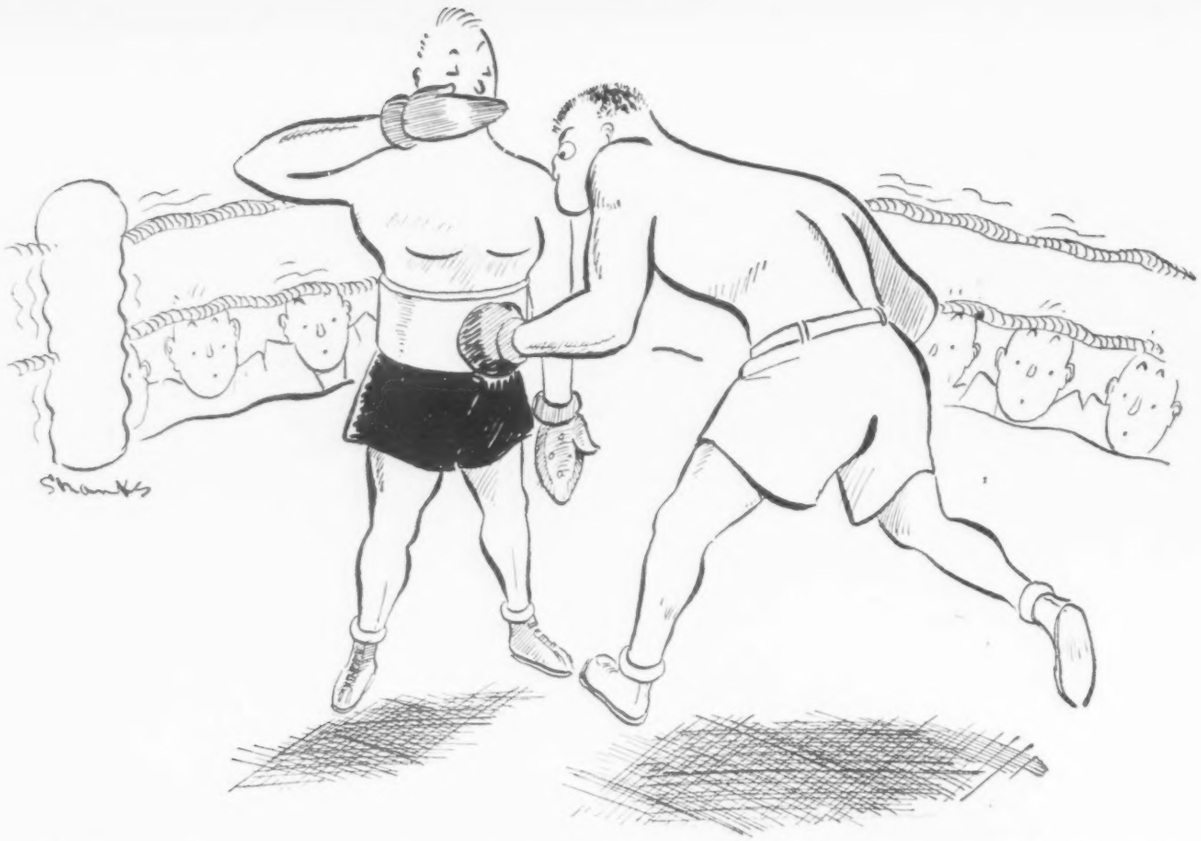
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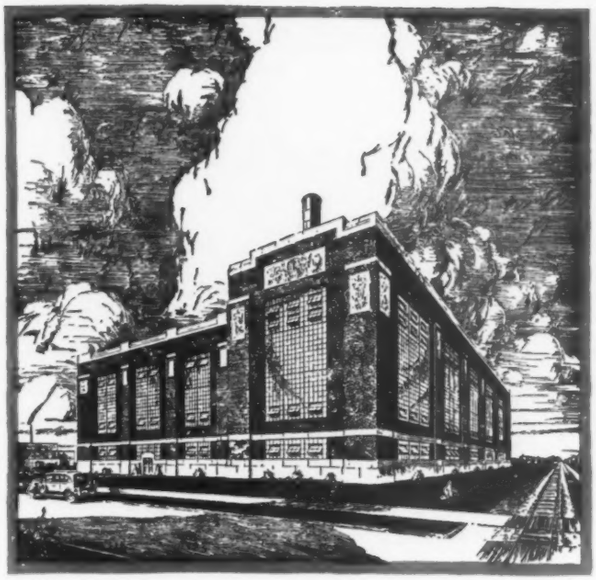
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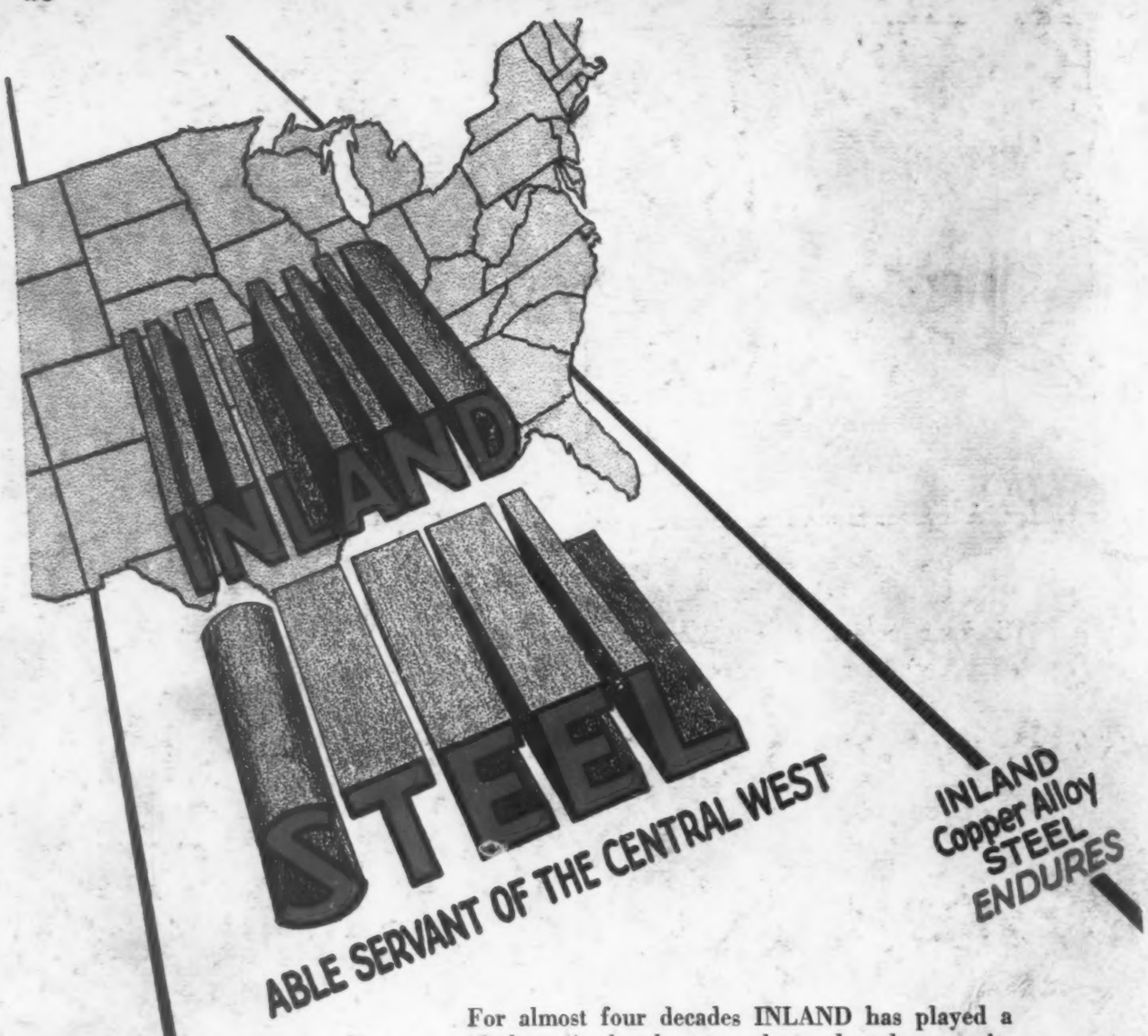
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